### THE

# ROYAL GAUGER;

Or,

Gauging made Easy,

As it is actually practifed by the Officers of his Majesty's Revenue of Excise. In Two Parts.

#### PART I.

Containing the practical Methods of finding the Area's and Contents of such Superficies and Solids, as are the Foundation of Gauging.

Also the Established Rules for finding the Contents of all Sorts of Cisterns, Coppers, Backs, Coolers, Tuns, Stills and Casks, when full, or Part empty: The Examples being performed both by the

#### PEN AND SLIDING RULE:

And this not in Ale, Wine and Malt only, but in the New Duties, viz. Candles, Sopes, Stareh, &c. which have been Duties substitling by Law almost 30 Years; and are very considerable Branches of the Revenue as well as of every Excise Officer's. Duty, tho' yet they have never been so much as once touch'd upon by any Author.

With the Officer's Duty in the Distillery.

#### PART II.

Shewing the necessary Steps to be taken for obtaining Employment in the Excise, with authentic Forms of such Certificates, Petitions, Oaths, &c. as are requisite for that Purpose.

#### Together with

Such Directions for the Officer's Conduct as are necessary for ascertaining and securing the respective Duties, to which the following Professions are liable.

- 1. Victuallers,
- 5. Malt Compounders, 6. Dealers in Cyder,
- 9. Tanners,
- 13. Chandlers, 14. Starch-makers,

- 2. By-Brewers,
  3. Common-Brewers,
- o. Dealers in Cyder,
  7. Wine Importers,
- 11. Oil Dreffers, 12. Sope-makers,
- 15. Paper-makers

Maltslers, [8. Distillers, 12. Sope-makers, 16. Hop-Planters.

A Work shewing young Officers the Perfection of Skill in discharging their Trusts, and very advantageous to those Traders, who would understand how to escertain the Amount of the respective Duties to which they are subject, without depending upon the Skill and Integrity of the King's Officer.

#### To which is added,

Cask-Gauging, &c. as practis'd at the Port of London.

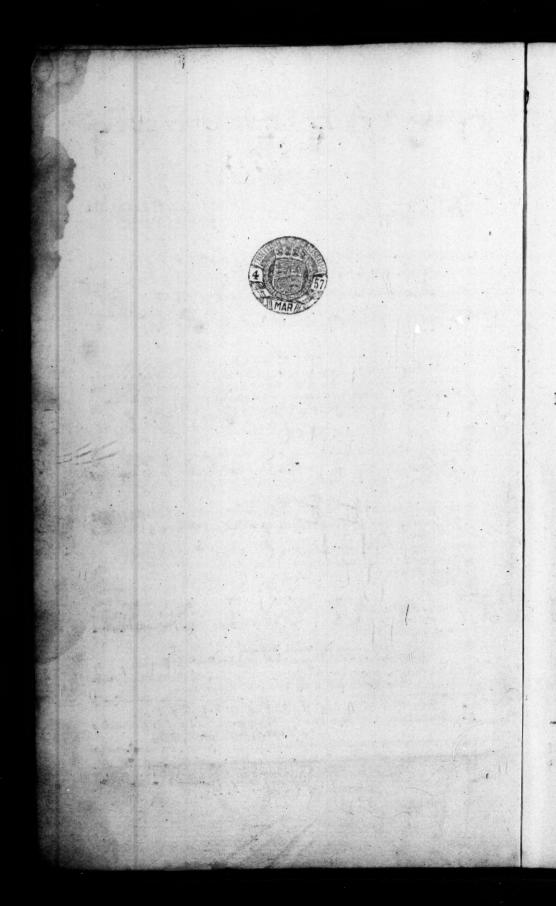
The whole illustrated with many Copper-plates, new designed, and much better adapted to the Subject, than in any Treatise of this Kind extant.

By CHARLES LEADBETTER,

Many Years a Gauger in the Royal Revenue of Excise, nown Teacher of the Mathematicks in London.

#### LONDON:

Printed for E. WICKSTEED, at the Black Swan in Newgate-freet, near Warwick-Lane. 1739.



# OFFICERS

Of His

MAJESTY'S Royal Revenue

Of

# EXCISE,

(Who are the best Judges of the Subject here treated of;)

And also

TO THE

BREWERS, MALTSTERS, DISTILLERS, &c.

Of

## GREAT BRITAIN,

The following

## TREATISE

OF

# GAUGING

Is Humbly Dedicated,

By

Their Faithful

And Obedient Servant,

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HE SLIDING-RULE, mentioned in this Treatife, is made and fold, (with all other Infiruments for Practical Mathematics to the utmost Perfection) by John Forvler, at the Globe by the Royal-Exchange.



Concerning the Quibbles and Objections of One JOHN WORGAN.

To the GAUGERS employed in his Majesty's Royal Revenue of the Excise and Others.

Mr Worgan, and Comp. bawing for above a Fortnight declined returning any Answer to my Reply, to his Three Remarks upon the Royal Gauger, concluding, I suppose, that the Publick would by this Time have forgot what I had said upon that Head, and that therefore their groundles Assertions might stand a better Chance to gain some Credit; for this Reason I have re-printed my Reply, that those who are acquainted with the Excise, and think it worth while to compare what Mr Worgan's anonymous Friends have supplied him with against it, may readily be convinced, how little such rambling Stuff deserves the Title of an Answer to it. If these Gentlemen (I do not include Mr Worgan, because every one that's acquainted with him must agree with me, that he is a crazy wrong headed Wretch, and knows nothing of the Matter) I say, if these Gentlemen could have proved, that the Revenue of the Excise, was not ascertained, charged, and collected, agreeable to what I have laid down, there can be no room to doubt but they would gladly have done it; their suggesting it without Proof goes for nothing, and they are bereby called upon to do it, if they can; which if they decline, I submit it to the Publick, what Opinion ought to be entertained of their Morals or Capacity. If the Method of Gauging, by which the Excise Duties now are ascertained, charged, and collected, and by which they have been so for many Years last past, is not the proper Method to be taught in a Treatise wrote (as the Title Page declares) upon the Subject of Gauging, as it is actually practised in the Excise, I must consess and collected, and by which they have been so for many Years last past, is not the proper Method to be taught in a Treatise wrote (as the Title Page declares) upon the Subject of Gauging, as it is actually practised in the Excise, ever were, and are ever like to be, two very different Things? But now it plainly appears, by their Answer, that their principal Aim and Business is only to throw Dirt and misrepresent, the better to impose upon such as are

A Reply to the Remarks on the ROYAL GAUGER, figned JOHN WORGAN, (for Self and Company.)

AVING lately published a Treatise under the following Title, the ROYAL GAUGER; or Gauging made easy, as it is actually practised by the Officers of his Majesty's Revenue of Excise; there has appeared in this Paper of the 5th and 8th of January, some scurrilous Remarks and Misrepresentations of some Parts of it; which should have given me no Concern, but for the Sake of those who have not seen my Book, and therefore may be liable to be imposed upon by the Air of Infallibility so conspicuous in the Remarker. Those who understand what Gauging is, as it is practised in the Excise, I am faitsfied are not to be bully'd into a Belief that the Quibbles and Conjectures of speculative and undisciplined Gaugers are to stand in Competition with the Injunctions of the Commissioners. What a strange Idea of the Excise must they have, who imagine the Gaugers are at Liberty to regard the five Varieties of Casks? But to come to the Remarks.

I. I am condemned, without Mercy, for faying (page 102) that the Contents of an Hyperbolical Conoid is in Proportion to a CYLINDER, as 5 to 12 \*, which the purblind Re-

I affert that \( \frac{5}{2} \) in Practice is near enough the Truth; the it is evident, that as the Transverse Axis and Intercepted Diameter differ, so will the Solidity of the Circumscribing Cylinder also differ in Proportion.

marker admits may be true in one particular Case; but little does this Pretender dream, that ONE particular Case, (as he calls it) is the ONLY Case that is ever taught in the Excise: This intelligent Gentleman seems quite ignorant that the Honourable Commissioners have enjoined their Officers to gauge and charge all Casks, let their Form be what it will, as a Spheroid ONLY, whose Proportion to it's Cylinder as practised in the Excise, is as 2 to 2.

Spheroid on Ly, whose Proportion to it's Cylinder as practiced in the Excise, is as 2 to 3.

II. But to come to the 4th and 5th Variety of Casks, which have given him so great a Concern for me, viz. the Hyperbolic Conoid and the Conoid. New he that carefully observes Plate 3. Fig. 4. (in my Royal Gauger) will soon be convinced, that in a Cask of those Dimensions, the Staves from Head to Bung differ very little from a firaight Line, or Side of a Cone, for which Geometricians have found out no nearer Rules than what I have laid down; but have Recourse to proper Factors for reducing those Casks to Cylinders, as you have them on Pages 134 and 136, by which the Contents of the Hyperbolic Conoid will be found to be 69.124, and the Conoid 68.802 Ale Gallons, and consequently the Difference is only Three Hundred and twenty-two Thousand Parts of a Gallon; and this may serve to seach the Remarker, that the one Figure may be of a quite different Kind (as he calls it) from another, yet he need not be surprized, or think it monstrous, that their Quantities should be nearly the same, for it is not the apparent Form, but the real Magnitude that determines their Contents. So that all the scurrious Confidence he has expressed about these Varieties of Casks, with respect to Gauging in the Excise, amounts to nothing:

It is great Pity this plausible understanding Gentleman, this sculking Coadjutor of Mr Worgan's, is not made a Commissioner; sure no Body can suspect but his great Knowledge and Experience in Affairs of this Kind, might be of wonderful Service to the Revenue!

III. But now comes the fatal Remark, which is to demolish the Royal Gauger, and this is prefaced with the grossest Scurrility, and then introduced in the following instalius Manner: And that no Man may have the least room to suspect any unsair Representation, I shall give it in his own Words, which stand thus, (Page 116.) and when he has said this, then he gives you the Definition, † exhibits the Figure of a Tun, but secrets the Rule which stands upon the very same Page with the Definition, and which was to reconcile it to the Figure, and when he has done this, concluding all is sinug and safe, he struts off in Triumph, and pretends that I affirm, (without any Restriction) that the Contents of FED and DEC are equal; whereas, if he had but pursued the Rule I had laid down, and which he had then under his Nose, he could not be ignorant that FED holds 37.69, and that DEC holds but 35.21 Ale Gallons, which is one Gallon and seventeen Hundred Parts of a Gallon less. Well, but I have said the Quantities are equal, I say so still, when the Tun is a Cylinder, and I likewise say, that when the Tun is the Frustum of a Cone, the Vacuity is more or less than equal, according as it is placed upon it's greater or less Base. But after all, what is this to the Business of Gauging as it is practified in the Excise? Worts, &c. are never gauged and charged in the Form of the Drip of a Tun. Those who are conversant in the Excise, are, or should be sensible, tho' this Remarker seems to know nothing of the Matter, that the Drip of the Tun, as well as the last four Varieties of Casks are introduced to exercise the Cu-

ziofity of Pupils, and not to be carried into Practice in the Excife.

Now we come to the Poffcript, which is an Original: So much of it as relates to the Royal Gauger being meer Scurrility and Blunder from one End to the other. I had cautioned Mr Worgan, sufficiently I thought, (in this Paper of the 4th of December) not to turn Gauger, and run his Head against a Post, by telling him, the FACTORS I had made use of for the 4th and 5th Varieties of Casks, as well as the Manner of taking the Drip of a Tun, had been approved of by the Commissioners, and referred him for Satisfaction, to Pages 79 and 84 of Bamford's Gauger, which was published with their Approbation: In answer to this he says, I bad endeavoured to excuse myself, by infinuating that whatever I had done therein, was expressly according to the Commissioners Directions; from which it is plain he will Fib a little: and when he has done this, he fets out railing, raving, and blundering like a Bedlamite. As I said, I had been talking to him of FACTORS for reducing those Casks to Cylinders, but he understanding nothing of the Matter, replies, Nothing can be more idle and foreign to the Purpose, every one, the least acquainted with Gauging, knowing, that the Divisors be talks about, are nothing more than certain fixed Numbers, to be used after the Content of a Vessel is found in Inches, to reduce it into Gallons. I must now beg leave to appeal to all Men living, who understand what FACTORS for reducing Casks to Cylinders are, whether the most disordered Wretch in Bedlam, could have made a more wild, absurd, and foreign Reply than this Pretender to Gauging, who, it is plain, is so very ignorant as not to know the Difference between a Factor and a Divisor, which, in the present Case, are as opposite as Black and White. What he immediately after supposes concerning the Drip of a Tun, betrays the same Degree of Ignorance, &c. as may appear from what I have said about it in the preceding Paragraph.

CHARLES LEADBETTER,

<sup>+</sup> See General Evening Post of the 5th or 8th of January : or Page 116, Plate 4. Fig. 9. of the Royal Gauger.

### The AUTHOR to the READER.



S GAUGING is one of the most useful Branches of the Mathematicks, and as I have had the Credit of an Employment under the Honourable Commissioners of his Majesty's Royal Revenue of Excise, I presume I need no Apology for the present Un-

dertaking.

The Compiler of the following Sheets, far from taking a malicious Satisfaction in laying before the World the Errors, Defetts, and Impertinencies of the Treatifes already extant upon the Subject of Practical Gauging, rather chuses to join with those who have long complain'd, that an useful and general Treatife relating to the Business of a Gauger in the Excise, has been extreamly wanted, which should treat of those Matters, after a natural and authentic Manner.

Every Officer of Experience, who has had the forming of Probationers for the Excise, will concur with me in Opinion, that the main Difficulty to bring young Pupils to consider those Things, which are to be the Subject of their future Conduct, into a proper Light, has received its Influence from the Direction of blind Guides, who have given their Minds a wrong Turn; and this Complaint, which every one must acknowledge to be well grounded, the Author apprehends will be removed for the future, by means of the ensuing Treatise; which may furnish every Writing Master and Accomptant with such an Insight into the Business and Duty of an Excise Officer, as their Scholars must necessarily reap the Advantage of.

Since Mr. E. HATTON, Philomath, and some others, as short-fighted as himself, have attempted to persuade the Publick, that Tables ready calculated are far more exact and ready in Practical Gauging, than the Sliding Rule; it may not be unfeafonable, for the Sake of fuch who are as ignorant in Gauging as himself, to observe, that if his Tables happen to be false printed, as we often find most Tables are, the Officer must act at random, and be in a State of great Uncertainty, not knowing whether he is right or whether he is wrong: Whereas by the Sliding Rule 'tis impossible he A 3

should ever err; for the Use of that Instrument being once well understood, which by the Directions I have given in the following Treatise it very easily may; the Officer, with the greatest Dispatch and Certainty, may, on all Occasions, come to the Exactness of the tenth Part of an Unit, which is as near as is ever required in Practice in the Excise; and I am persuaded that the said Mr. HATTON\*, Philomath, and others, who have taken the most Pains to decry the Sliding Rule, are truly ignorant of its Excellency and Use.

To those who understand how far the Operations in Division, if set down at large, would have extended this Treatise, and of how little Service it would be to the Reader, I need no Excuse for omitting them.

Being sensible that the Officers of Excise have little Leisure to apply their Minds to the Speculative Part of Geometry, for that Reason I have omitted the Demonstration of some of the Rules.

Having

\* This Pretender had once the Vanity to publish a Treatise of Gauging, which he intitled The Gauger's Guide, or Excise Officer instructed; which met with such a Reception from the

Public, as his unprecedented Affurance justly deserved.

Befides this notable Author (in his Comes Commercii) out of his extraordinary Sagacity and profound Skill in the Mathematics, has condescended to oblige the World with Tables, by the Help of which he undertakes any one may measure all Sorts of Superficies and Solids [without understanding any Thing of the Matter, either before or after they have done: And what hopeful Measurers those must be, who can neither multiply, or divide without the Help of printed Tables, I submit it to every judicious Man to determine.] At the End of those Tables there are two for gauging Ale and Wine: Now those Tables were first publish'd by this Writer in the Year 1699, and these he reprinted in 1729, in his said Treatise of Gauging; which demonstrates that after 30 Years Deliberation he remained the same skilful and ingenious Gauger, and that his Qualifications to instruct others ought not to be called in Question. But I take my leave of him, since I understand that the Abilities and Merits of this Writer will shortly be more particularly enquired into by the ingenious Author of the Novus Comes Commercii, or the Trader's NEW Companion; which Treatise, full of useful and commodious Knowledge, will shortly

make its Appearance.

When selfish, mercenary Projectors, who disregard every Thing but their own Interest, have tempted a necessitious unskilful Author out of his Dep. h; what is it but the grossest Abuse and Imposition that the Public has to expect from such a Confederacy? And how slight an Offence soever this, as it respects the Public, may appear in the Eyes of those, who have long drawn' their Support and Fortunes from such Practices; and who are always ready with their Posses, to make a Descent upon the Reputation of any Man, that dares presume to pursue his Interest, in Conjunction with that of the Public, rather than with that of these Men: I say, how slight soever these Crimes may appear to those who have been habitually guilty of them; yet this their Conduct must necessarily raise such shocking Sentiments in the Minds of the discerning and judicious Part of Mankind, that all the formal Cant, all the supercisious Grimace, and all the authoritative Gravity in the World will never be able to remove; and it is no small Reproach to a Constitution so eminent for the Encouragement of Learning, that a few selfish and unreasonable Men, under specious Pretences, are permitted thus to oppose it: Because some Men for Want of Skill, or a good Intention, have obtunded upon the Public a bad Performance, that therefore no Man can in Point of Justice or Honour oblige the World with a better upon the same Subject, is a Way of Reasoning, so teandalously selfish, and unpopular, that I am surprised there can be one Man living, who is not assume the superior of the surprised there can be one Man living, who is not assume of it.

Having been frequently applied to when I was in the Excise, as well as since, to adjust the Differences relating to measuring Marl-pits and Cord-wood, I have been tempted to say something upon those Heads; and I hope the Reader, who thinks it foreign to the Subject, will excuse me for so doing.

I must intreat those Readers, who are distatisfied with the Disposition of the Materials that compose the second Part, to peruse it in the Order it stands in the Table of Contents.

The Rationale and Progress of the Excise seem little understood, and therefore I think it incumbent on me, as to its Rise, to take notice, That though by the Law of Nature all Things were originally common, and all Perfors equal, there being then neither King nor Subject; yet when the Law of Nature came to be limited by the Law of Nations, and Property came to be claimed, Kings or Rulers became absolutely necessary, to maintain and defend such Property, (by which I mean Life, Liberty, and Estate:) And in order to support those Kings or Rulers in their Government, and to defray the Expences which they must inevitably be at in protecting the Publick, and administring Justice to every Member, Taxes and Duties were granted them: Then, as to the Reasonableness and Justice of fuch Demands of Duties or Taxes by the Prince, and the Obligation to a ready and chearful Obedience and Compliance in the Payment thereof by the Subject, there is no less Testimony and Authority than the Holy Scriptures.

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an ay How provoking therefore must their Conduct be before God and all reasonable Men, who are so perverse as to offer Insults and Indignities to the Person of the King's Officer, and are eternally on the Watch, for Opportunities to render him contemptible and odious to the World? Such Men seem ignorant that though the Excise Duties are made payable to the King, and are collected in bis Name, yet only a very small Part thereof is applied to his own Use, while the much greater Share, as nine Parts in ten thereof are applicable and appropriated to discharge the National

National Debts; which, until paid, remain an heavy Charge upon the whole Nation in general.

Many judicious and ingenious Gentlemen, who have been acquainted with the Bulinels and Revenue of the Excise, have been under the greatest Astonishment, that since they have the Laws of the Land for their Foundation, and are managed in all their Branches with the greatest Prudence and Oeconomy upon Earth, that they have hitherto been fo little understood by Manufacturers and Traders: But in answer to this, the Business of the Customs long remained in the same Situation, to the great Trouble of the respective Officers, and the extream Diffatisfaction of the Subjest; and after several Attempts, the Laws and Business relating to that Branch of the Revenue have been reduced to Method, and the Veil withdrawn \*, to the great Improvement of that Branch of the Revenue, the Ease of the Officer, and the entire Satisfaction of every honest, wellmeaning Subject.

The Charges of this Impression arising from the Smalness of the Letter, the Goodness of the Paper, and the Expences of Graving, Painting, &c. are Articles, at first Sight, which will not leave any judicious Purchaser the least Reason to complain that he has not a Pennyworth for his Penny.

\* See A complete View of the British Customs, containing, inter alia, the Rules, Orders, Directions, Allowances and Regulations, &c. relating to the Business of the Customs.

Having forgot to furnish the young Officer, in its proper Place, with Instructions concerning the seizing of Brandy, Rum, &c. rather than quite omit it, I have here inserted it.

### Instructions for making Seizures.

The Officer, when he makes a Seizure of Brandy, Rum, &c. he must lay his Hand upon the Casks or Vessels so seized, and he must declare that he seizes such Brandy, Rum, &c. and likewise the Casks and Vessels containing the same, for the proper Use of his Majesty and himself. But in case the Officer happens to be alone when he makes such Seizure, he must afterwards, in the Presence of Witnesses, lay his Hand again upon the Casks and Vessels, and make the like Declaration as before directed.

All Informations on Seizures must be laid in the Name or Names of the Officer or Officers, who make such Seizures.

### A Table of the CONTENTS of the FIRST PART.

### Of Decimal Arithmetick.

CHAP. I. OF Notation of Deci-	Of Contractions in Multiplication Page 15
CHAP. II. Of Reduction of Decimal	CHAP. VI. Of Division of Decimal
Fractions 2	Fractions 16
CHAP. III. Of Addition of Decimal	Of Contractions in Division 18
Fractions	CHAP. VII. Of the Single Rule of
CHAP. IV. Of Subtraction of Deci-	Three 20
mal Fractions 13	CHAP. VIII. Of the Extraction of
CHAP. V. Of Multiplication of De-	the Square Root 21
cimal Fractions 14	CHAP. IX. Of the Use of the Square
	Root 24

### Of the Sliding Rule, &c.

CHAP. X. Description of the Sliding-Rule 27	CHAP. XVI. To find a Geometrical Mean 43
A Table for dividing the Line of Num-	CHAP. XVII. To extract the Square
bers to any Radius 31	Root 44
To find an Ale-Area 33	CHAP. XVIII. To extract the Cube
To calculate Diagonal Lines 34.	Root 44
Diagonal Lines for London Casks bow made 35	CHAP. XIX. Of Multipliers, Divi- fors and Gauge-Points 46
CHAP. XI. Of Numeration 35	A copious Table of ditto for Squares
CHAP. XII. Of Multiplication 35	and Circles
CHAP. XIII. Of Division 38	Several Problems about Circles, &c.
CHAP. XIV. Of the Single Rule of	from Page 53 to Page 58
Three Direct 39	A Circle the most capacious of Fi-
CHAP. XV. Of the Single Rule of	gures 60
Three Inverse 40	A Table of Gauge-points, &c. for Feet, Gallons, Bushels, &c. 62

### Of Gauging Superficies.

CHAP. XX. Of gauging all	Manner	Of Regular Polygons	69
of Superficies, viz.	63	A Table of Regular Polygons	71
A Square	63	A Sector of a Circle	72
A Parallelogram		A Semi-Circle	73
A Rhombus	65	A Quarter of a Circle	75
A Rhomboides		A Segment of a Circle	76
A Triangle	66	A Segment of a Circle on Hunt's	Rule
A Trapezium	67		79
Of Irregular Figures	68	A Space	80
			An

X

### Of Gauging Solids.

CHAP. XXI. How to gauge	all Sorts	The Parabolic Conoid	101
of Solids, viz.	-89	The Hyperbolic Conoid	102
The Cube	89	The Parabolic Spindle	104
The Parallelipipedon	90	The Globe or Sphere	105
The Prism	92	The Segment of a Globe	109
The Cylinder	93	The Frustum of a Globe	110
The Cone	95	The Spheroid	112
The Frustum of a Cone	97	Of the Proportion of Solids	113
The Pyramid	100		

### Of Gauging Open Aesfels.

A Back or Cooler 119
To find the Dip of a Back or Cooler
120
A Copper with a Rifing Crown 120
A Still (See also Chap. XXIX.) 123

### Cask Gauging.

CHAP. XXIII. Of the feweral Va-	The lower Frustum of two Cones 135
rieties of Cafks, viz. 125	
A Spheroidal Cask 127	136
The middle Frustum of a Parabolic	Of a Circular Spindle 137
Spindle 129	CHAP. XXIV. To find the Ullage of
The lower Frustum of two Parabolic	a Cask lying 139
Conoids 131	To find the Ullage of a Cask standing
The lower Frustum of two Hyperbo-	141
lic Conoids 133	

### Of Gauging warm Worts.

Wants	How to deduct the Allowance for Warm Worts 145
See also Chap, II. and XII. of Part II.	CHAP. XXVI. How to reduce Ale Measure to Wine Measure 147

### Malt. Sauging.

CHAP. XXVII. A Table of Divisional Gauge-Points, &c.	fors	How to gauge a Couch How to gauge a Floor	150
			151 To

To know whence the Charg	e will a-	How to money Malt-Charges Pag. 1	5 3
rife	Page 151	See also Chap. XVII. and XVIII	
To gauge Circular Cifterns,	Couches,	of Part II.	
and Floors	152	How the Cash-Tables for Malt a	re
How to gauge a By-Tub	152	made 15	54

### Of Candles.

CHAP. XXVIII. Of Candles	154	For the Drawback on Exportation, fee
See also Chap. VI. Part II.	34	Chap. XIII. Part II. 62

### Of the Diffillery.

155

CHAP. XXIX. Of the Characters to be made use of 156	CHAP.XXX. Tables of the Measures of Exciseable Liquors 162
How the Officer must make his Surveys	CHAP. XXXI. The Rates of Liquors and other Exciseable Commodities
How to cast up a Day's Survey 158	165
How to make a Charge from Melaf-	CHAP. XXXII. How to measure the
fes Wash 158	different Strengths or Gravity of
How to make a Charge from Malt	Liquors 167
Wash 159	Tables of Specific Gravity and their
How to make a Charge from English	Ufe 168
Materials 160	CHAP. XXXIII. Of Cordwood, the
How to make a Charge from Low Wines 160	different Customs and Manner of measuring it 171
For the Drawback on Exportation,	CHAP. XXXIV. Of Marl-pits, and
fee Chap. XIII. Part II. 63	the Method of measuring them 173
The Case of the Malt Distillers, &c.	CHAP. XXXV. Of taking Distances
161	177

### A Table of the CONTENTS of the SECOND PART.

THAP. I. Shewing what is to be observed and done by those who would qualify themselves for the Employment of an Officer in the Excise; together with the Forms of those Oaths, Certificates, &c. which are neceffary for that Purpose, viz. Page 1

A Certificate and Recommendation from several Gentlemen in the Country,

A Certificate of the Petitioner's Age 1 The Oath that the Petitioner has made no indirect Application for an Order to be instructed A Certificate of the Petitioner's Abilities

lities from the Collector or Super-A Certificate that the Officer has taken the said Oaths The Form of a PETITION for an A Certificate that the Auditor of Ex-Order to be instructed cife has register'd the Officers taking The Collector's Duty, when applied the faid Oaths to for a Certificate The Form of a Gauger's COMMIS-The Supervisor's Duty, when applied SION to for a Certificate A Certificate that the Officer has re-A Certificate from the Supervisor and ceived the Sacrament according to Officer that the Petitioner is comthe Usage of the Church of Engl. 6 pleatly qualify'd for a Gauger The Test Oath For the Instruments he must have, The Oath of Abjuration fee Page 10. The Form of the Author's Discharge, The Oaths of Allegiance and Suprewith the Collector's Letter accombanying it The Oath of OFFICE The true Reason and Grounds of the Author's Discharge

CHAP. II. Shewing the Business and Duty of those Officers of the Excise, who survey Vietuallers, By-Brewers, and Common Brewers; so as to prevent those Traders from evading the Duty, and defrauding the Revenue.

Forms of the Voucher and Ab-See Chap. XIII. Part II. 51

For the Scheme of a Division, and For the Drawback on Exportation. See Chap. XIII. Part II. stract, with their Indorsements. For Cash-Tables for the Excise ready caft up. See Ch. XVIII. Part II.

CHAP. III. Shewing the Business and Duty of those Officers of the Excise that survey Maltsters, Malt Compounders, and those who deal in Cyder and Perry, so as to prevent those Traders from evading the Duty, and defrauding the Revenue

For the Forms of a Voucher and Abstract, with their Indorsements. See Chap. XII. Part II.

For the Drawback on Exportation. See Chap. XIII. Part II. For Cash-Tables for the Excise, ready caft up. See Chap. XVIII. Part II.

CHAP. IV. Shewing the Business and Duty of those Officers of Excise, who survey Tanners, Tawers, Oil-Dresfers, and Parchment-makers, fo as to prevent their evading the Duty, and defrauding the Revenue

A Table, shewing the Duty to be paid for all Sorts of Hides, Skins, &c. that are dress'd in Oil, taw'd or tann'd in Great-Britain Tables

- Tables at 151. and 301. per Cent. For the Drawback on Exportation. ad Valor. for Tanners, &c. See Chap. XIII. Part II. See also Chap. XIV. Part II.
- CHAP. V. Shewing the Business and Duty of those Officers of the Excise who survey Soap-makers, so as to prevent their evading the Duty, or defrauding the Revenue
- Directions for the understanding the For the Drawback on Exportation. Nature of that Manufacture 30 For the Drawback when confumed in making Cloaths, &c. Ch. XI.

See Chap. XIII. Part II. For Castile-Soap. See Chap. XV. Part II.

CHAP. VI. Shewing the Business and Duty of those Officers of the Excise, who survey Tallow-Chandlers in the Country, fo as to prevent their evading the Duty, and defrauding the Revenue.

For the Drawback on Exportation. See Chap. XIII.

62

- CHAP. VII. Shewing the Business and Duty of those Officers of the Excise who survey Starch-makers, so as to prevent the Maker from evading the Duty, or defrauding the Re-38 venue
- Directions for understanding the Na- For the Drawback on Expartation, ture of that Manufacture 38 See Chap. XIII. Part II.
- CHAP. VIII. Shewing the Duty and Business of those Officers of Excise who survey Hops, so as to prevent the Planters from evading the Duty, or defrauding the Revenue ' 40
- CHAP. IX. Shewing the Business and Duty of those Officers of the Excise who survey Paper-makers, so as to prevent the Makers from evading the Duty, or defrauding the Revenue.
- Directions for understanding the Na- For the Drawback on Exportation, ture of that Manufacture See Chap. XIII. Part II.

CHAP.

CHAP. X. Of the Duty and Business of those Officers of Excise who survey Printers of Silk, Linnen, &c. so as to prevent the Printers from evading the Duty, or defrauding the Revenue.

48

For the Drawback on Exportation, See Chap. XIII. Part II. 63

CHAP. XI. Concerning the Drawback on Soap employ'd in making of Cloths, &c. and of making up the Accompts for the Manufacturers to obtain it, with the Forms of the Affidavits required by Law.

CHAP. XII. Containing a Gauger's Commission; a Scheme of a Division; a Specimen of a Dimension Book; the Form of a Voucher and Abstract for Beer, Ale, and Cyder; the Form of a Voucher and Abstract for Malt and Cyder, with their respective Indorsements

A Gauger's Commission The Form of Indorsing the faid Ab-51 A Scheme of a Division A Specimen of a Dimension-Book Form of a Voucher for Malt and Cv-55 The Form of an Indorsement of the The Form of a Voucher for Ale, Beer, \*\*55 faid Voucher and Cyder The Form of an Abstract for Malt and The Form of Indorsing the faid Vou-The Form of an Abstract for Ale, The Form of an Indorsement for the Beer, and Cyder Said Abstract 58

CHAP. XIII. Instructions for obtaining the Allowance of the Drawbacks, or Bounties on the Exportation of several Exciseable British-made Goods to Foreign Parts, viz. Beer, Ale, Mum, Cyder and Perry, Malt of Barley and Wheat; Leather, tann'd, taw'd, or dress'd in Oil, &c. Boots, Shoes, Gloves, &c. Sope, Candles, Starch, Papers, Pasteboard, &c. Silks, Callicoes, Linens, &c. Spirits drawn from Barley, Malt, or other Corn.

CHAP. XIV. Of CASK-GAUGING, as practis'd at the Water-side in the Port of London; together with Remarks concerning some Imported Goods, viz. Spruce Beer, Hides, Hops, Mum, Oils, Rum, Wines, &c. necessary for those Officers who survey Sea-Port Towns 64

CHAP. XV. Of SHIP-GAUGING, viz. to find the Burthen or Tonnage, &c. 71

CHAP. XVI. Containing new Tables for a Gauger's Salary at 50 l. per Annum for the Common Year, and for the Leap Year, with their Explanation, Construction, and Use, with Directions for deducting the Charity; also a Table for finding the Number of Days for any Time assign'd; with a Table of proper Multiplicators for Salaries, from 5 to 1000 l. per Annum.

The Table for Salary at 50 l. per A Table for finding any Number of Days

The Table for Salary at 50 l. per Days

The Explanation and Use of the said

Leap Year

Table

T

CHAP. XVII. Concerning the STANDARD Winchester Bushel and Gallon kept in his Majesty's Exchequer; shewing when and how their Contents were settled by Act of Parliament. Also the STANDARD Averdupoise and Troy Weights kept in the Exchequer, compared with each other, and with the said Bushel, half Bushel, Peck, and Gallon; with Tables for sinding whether the Content of any of the said Measures are equal to the Standard, or not, when their Diameter or Depth vary from it. 93

CHAP. XVIII. Cash-Tables for the Excise payable by Victuallers, Common Brewers in the Country, Common Brewers in London, and for Maltsters.

Tables for Victuallers for Beer and Tables for Common Brewers in London for Beer 103

Tables for ditto for Small Beer 99 Fables for ditto for Ale 104

Tables for Common Brewers in the Tables for ditto for Small Beer 105

Country for Beer and Ale 101 Tables for Maltsters in the Cistern 105

Tables for ditto for Small Beer 102 Tables for ditto OUT OF the Cistern 107

CHAP. XIX. A List of the Commissioners of his Majesty's Royal Revenue of Excise, &c. in England, and other Officers employ'd therein, with their respective Salaries.

The following Errors of the Press having been observed since the Sheets were printed off, the Reader, before he peruses the Book, is desired to turn to the respective Pages, and either correct them, or draw his Pen under them, to prevent his mistaking the Author's Meaning.

#### ERRATA in PART I.

Pag.	Line	Errors.	Corrected.	Pag.	Line	Errors.	Corrected.
27 23 31 33	35 16 15 43 35	19 Inches 92650000 Second Terms 30000000000 150.42 Tenths, 63662030	19 ½ Inches 92650000  Second and 3d Terms 80.0000000000 2150.42 Tenths; It's one Place too near the right Hand, but the Product is right.	70 70 122 169	35 30 ult. 30 40 40 21	2756 67 200575 482 Diwide; Diwifers 16	B. A. B. A2756 67.200575 282 Divide, Divifors or IG = 20.2: Wheaten Meal

#### In PART II.

Pag.	Errors.	Corrected.	Pag.	Line	Errors.	Corrected.
444	LeverpoolDivif. Survey Hier	Leverpool 1st Divis. Surveyor His	19 24 52	15 21 15	Peace-Office In Page 7. Office (in Notes)	Peace-Officer In Page 6. Officer

Since I could not in this Treatise well avoid sometimes making use of the common Algebraic Signs, or Characters, I shall here explain them.

Signs. Names	Is the Sign of Addition, as 7+3 is 7 more 3, and fignifies that
	the Numbers 7 and 3 are to be added into one Sum: The like
+ More	is to be understood where several Numbers have this Sign be-
	twixt them; as 23+7+91+5, &c. denotes that these Num-
\$ 1 mg	bers are all to be added into one Sum.
55	Is the Sign of Subtraction, as 8-3 is 8 lefs 3, and fignifies that
- Less	3 is to be taken from 8, that their Difference may appear.
	Is the Sign of Multiplication, as 8×3 is 8 into 3, and fignifies
× Into	that 8 is to be multiplied into, or with 3.
	Is the Sign of Division, as 9 - 3 is 9 by 3, and fignifies that 9
÷ By	is to be divided by 3.
10	Is the Sign of Equality, as 8=8; or 8+4=12; or 8-4
= Equal	= 4, &c. that is 8 is equal to 8, and 8 more 4 is equal to 12,
	and 8 less 4 is equal to 4, &c.
	Is the Sign of Proportion, and :: is always plac'd betwixt the revo
	middle Numbers in Proportion, or the Golden Rule or Rule of
So is	Three; thus 3:6::4:8, which must be read thus, as 3 is
****	to 6, fo is 4 to 8.
	Is the Sign that the Number to which it is join'd, is fquared:
9.	As in Page 86, &c.
	110 m 2 mg. 00, Ot.

# Royal Gauger.

### PART I.

### CHAP. I.

NOTATION \* of Decimal Fractions +.



OTATION of DECIMALS is different from that of Whole Numbers; for whole Numbers increase from the Right Hand towards the Left in a tenfold Proportion from Unity or one; and Decimals decrease from Unity, in the same Propor-

tion from the Left Hand towards the Right: The following Table makes this more evident.

Unite	1.	Unites one Integer.
Primes	.i °	One Tenth Part of the Integer.
Seconds	.01	One Hundredth Part.
Thirds	1001	One Thousandth Part.
Fourths	1000.	One Ten Thousandth Part.
Fifths	10000.	One Hundred Thousandth Part.
Sixths	.000001	One Million-Part.
Sevenths	1000000	One Ten Million-Part.
Eighths	.00000001	One Hundred Million-Part.
Ninths	1000000001	One Thousand Million-Part.

So that Decimal Fractions are of several Denominations, or Names, as Primes, Seconds, Thirds, &c. and because the Denominator is always 1, with as many Cyphers annexed as there are Decimal Places; for this Reason the Numerator or Decimal is always wrote alone without the Denominator; fo if I would express Twenty-five Hundredth Parts of any Thing, which vulgarly stands thus 25, because the Denominator is 1, with as many Cyphers prefixed as there are Decimals or Places in the Numerator, it is always expressed thus .25; and 123 thus .123, and 15382 thus .5382, &c. And because Vulgar Fractions are the Foundation of Decimals, it is necessary to shew how to REDUCE a Vulgar Fraction to a Decimal. Part I. CHAP.

Stinct Idea of each Place or Figure of it.

† Note, Because the Sliding Rule is calculated for Decimal Fractions, it is requisite the Learner be made asquainted therewith before he proceeds to use the Rule itself.

Notation or Numeration in Arithmetick is the true Diffinction, Estimation, and Pronumciation of Numbers; or the Rule to read any Number, tho' never so great, and to have a di-

#### CHAP. II.

### \* REDUCTION of Decimal Fractions.

oreduce a Vulgar Fraction to a De-

The RULE.

Add to the Numerator of the given Vulgar Fraction any Number of Cyphers at Pleasure,

and divide that Sum by the Denominator, the Quotient is the Decimal equal to the given Vulgar Fraction.

For as

The Denominator of the given Vulgar Fraction

Is to the Numerator,
So is an Unite, with so many Cyphers annexed, as you intend
your Decimal shall have Places,
To the Decimal required.

See these Examples, and mark them well.

1. Reduce \(\frac{1}{4}\) to a Decimal.
4)1.00(.25)

2. Reduce \(\frac{1}{2}\) to a Decimal.

3. Reduce \(\frac{3}{4}\) to a Decimal.

4)3.00(.75

4. Reduce 11 to a Decimal.

80)11.0000(.1375

See Plate A. Fig. 1.

N.B. The first Example is wrought thus by the Sliding Rule. Set 4 upon B, to 1 upon A, and against 100 upon B\*, is .25 upon A, the Decimal fought.

Or.

Set 4 upon A, to 1 upon B, and against 100 upon A, is .25 upon B, as before: But I shall explain this more at large, when I come to treat of the Sliding Rule.

2. To reduce a Compound Vulgar Fraction to a Decimal.

Example I. Reduce  $\frac{2}{3}$  of  $\frac{3}{5}$  of  $\frac{5}{8}$  to a Decimal.

First, Reduce them to a single Fraction, by multiplying all the Numerators together, for a new Numerator, which make 30; 2dly, All the Denominators multiplied together, make 120; which placed under the other is this single Fraction  $\frac{30}{120}$ , or  $\frac{3}{12} = \frac{1}{4}$ , whose Decimal will be found .25, as before.

Example 2. Reduce  $\frac{1}{4}$  of  $\frac{1}{2}$  of  $\frac{3}{4}$  of any Thing to a Decimal Fraction.

We suppose the Reader to be acquainted with the four first Rules of Vulgar Arithmetick; for which Reason we place Reduction before Addition; tho some Proficients in Decimals place Reduction after Division.

By the Directions above I find it to be this fingle Fraction 3.

32)3.00000(.09375

Note, In every Quotient that arises in finding a Decimal Fraction, there must be as many Decimal Places as you add Cyphers to the Numerator of the given Vulgar Fraction; and what Places fall short must be supplied by presixing Cyphers to the Lest-Hand of the Decimal. Thus in the Example above, there is one Cypher presixed on the Lest Hand of the Quotient 9375; so that the true Quotient or Decimal is .09375.

In finding the Decimal of Money, Weights, Measures, Time, Motion, &c. you must reduce what you are seeking the Decimal of, into the lowest Name mentioned, and divide by what you design for the Integer reduced into the same Name; and

the Quotient thence arising is the Decimal sought.

Example 1, in English Money.

9. What's the Decimal of 1 s. a Pound being the Integer?

A. It is this Compound Vulgar Fraction 2.5.

20)1.00(.05

Example 2.

2. What's the Decimal of 1 d, a Pound being the Integer?

A. It is this Compound Vulgar Fraction  $\frac{1}{12}$  of  $\frac{1}{20} = \frac{1}{240}$ .

240)1.00000000(.00416666

Example 3.

2. What's the Decimal of 1 Farthing, a Pound being the Integer? A. It is this Compound Vulgar Fraction  $\frac{1}{4}$  of  $\frac{1}{12}$  of  $\frac{1}{20} = \frac{1}{900}$ .

960)1.00000000(.00104167

After the above manner, is the common Decimal-Table of Money calculated in most Books treating of Decimals.

Thus if you require to find the Decimal of 12 s. 9 d. 1/2, 2 Pound being the Integer, the Work will stand thus.

s. d. 12  $9^{\frac{1}{2}}$ 

153

4

960)614.00000000(.63958333

### Reduction of Decimals. Part I.

### Of TROY WEIGHT.

2. What's the Decimal of 9 12 20, a Pound Weight being the Integer?

OPERATION.

Pound Troy, the Quotient will be .803472 the Decimal fought.

### Of Apothecaries Weight.

The denominative Parts are Pounds, Ounces, Drams, Scruples, Grains.

That is 20 Grains make one Scruple, 3 Scruples make one Dram, 8 Drams make one Ounce, and 12 Ounces make one Pound.

2. What's the Decimal of 10 6 1 12 a Pound being the Integer?

5760)5192.000000(.901371 Answer.

### Of AVERDUPOISE WEIGHT.

The \* denominative Parts are Tuns, Hundreds, Quarters,

Pounds, Ounces, Drams.

That is 16 Drams make one Ounce, 16 Ounces make one Pound, 28 Pounds make one Quarter of a Hundred, 4 Quarters one Hundred, and 20 Hundreds make one Tun.

Q. What's the Decimal of 16 2 20 12 10, a Tun being the Integer?

A. Thefe

c. q. lb. oz. dr.
A. These 16 2 20 12 10 reduced into Drams are 478410, which divided by 573440, the Drams in a Tun Weight, gives in the Quotient .8342808 the Decimal fought.

Of WINE-MEASURE.

heads, Gallons, Pottles, Quarts, Pints.

The Denominative Parts are Tuns, Butts or Pipes, Hogf-tilled spirituous Liquors, Oil and That is 28 % Cubic Inches, are one Pint, 2 Pints make one Cyder are may uart, 2 Quarts make one Pottle, 2 Pottles make one Gallon. Quart, 2 Quarts make one Pottle, 2 Pottles make one Gallon, 63 Gallons make one Hogshead, 2 Hogsheads make one Pipe or Butt, 2 Pipes or Butts make one Tun.

Q. What's the Decimal of I 1 a Tun 50 the Integer?

A. The given Quantity reduced into Pints are 1919, which divided by 2016 the Pints in a Tun, the Quotient is .951884 the Decimal fought.

Of ALE MEASURE at LONDON, and within the Bills of Mortality.

In the The Denominative Parts are Barrels, Gallons, Quarts, Pints. Beer, strong and That is 35 \(\frac{1}{4}\) cubic Inches make one Pint, 2 Pints make one small are all one, want. Quart, 4 Quarts make one Gallon, 32 Gallons make one viz. 34 Gallons Barrel. to the Gallon.

2. What's the Decimal of 29 3 1 a Barrel the Integer?

119

256)239.000000(.933593 Anfw.

### Of BEER MEASURE at LONDON.

The Denominative Parts are Butts, Barrels, Kilderkins, Fir-

kins, Gallons, Quarts, Pints.

That is, 2 Pints make one Quart, 4 Quarts make one Gallon, 9 Gallons make one Firkin, 2 Firkins make one Kilderkin, 2 Kilderkins make one Barrel, and 3 Barrels make one Butt.

2. What's the Decimal of 2 being the Integer? 2	k. 1	f.	g. 5	9. 1	p. 1, 2	Butt
5 2		er 7/				
11 9 1 1 1 1 9 1 1 1 1 1 1 1 1 1 1 1 1			sk sk			
104						

864)835.000000(.966435 Answer

### Of WATER MEASURE.

Water Measure is so called from measuring of Coals upon the River of Thames, at London; and the Bushel by which Coals are measured contains 19 Unches Diameter from Out-side to Out-fide, and 8 Inches deep, with a plain and even Bottom; and fuch a Bushel contains 2389.179195 square or cubic Inches; 36 of these Bushels make one Chaldron; 33 Quarts makes one Bushel, and 2 Pints make one Quart.

9. p. 2. What's the Decimal of 20 27 1, a Chaldron the Inte-

A. These reduced into Pints, are 1375, which divided by 2376 the Pints in a Chaldron, the Quotient is .5787037, the Decimal fought.

### Of DRY MEASURE.

The Denominative Parts are Lasts, Weys, Quarters, Coombs,

Bushels, Pecks, Gallons, Pints.

That is 33.6 cubic Inches make one Pint, 8 Pints make one Gallon, 2 Gallons make one Peck, 4 Pecks make one Bushel, 4 Bushels make one Coomb, 2 Coombs make one Quarter, 5 Quarters make one Wey, or Load, 2 Weys make one Last.

w. q. c. b. p. g. p. 2. What's the Decimal of 0 4 1 1
Last being the Integer?

A. These reduced into Pints are 2418, which divided by 5120 the Pints in a Last, the Quotient is .472265, the Decimal fought.

Of LAND MEASURE.

The denominative Parts are Acres, Roods, Poles or Perches. That is, 40 Perches makes one Rood-land, 4 Rood-lands one 2. What's

### Chap. II. Reduction of Decimals.

2. What's the Decimal of 1 10, an Acre the Integer?

A. These reduced into Perches are 50, which divided by 160, the Quotient is .3125, the Decimal sought.

### Of LONG MEASURE.

The denominative Parts are Miles, Furlongs, Poles, Yards, Feet,

Inches, Barley Corns.

That is, 3 Barley Corns make one Inch, 12 Inches make one Foot, 3 Feet make one Yard, 5 ½ Yards make one Pole, 40 Poles make one Furlong, 8 Furlongs make one Mile.

2. What's the Decimal of 0 27 4 2 10, a Mile being

the Integer?

A. These reduced into Barley Corns are 16572, which divided by 190080 the Barley Corns in a Mile, give in the Quotient .08718434, the Decimal sought.

### Of YARD MEASURE.

The denominative Parts are Yards, Quarters, Nails. That is 4 Nails make one Quarter, 4 Quarters make one Yard.

Q. What the Decimal of 3, 1, a Yard the Integer?

A. These reduced into Nails are 13, which divided by 16 the Nails in a Yard, the Quotient is .8125, the Decimal sought.

### Of TIME.

The denominative Parts are Years, Months, Weeks, Days,

Hours, Minutes, Seconds.

That is 60 Seconds make one Minute, 60 Minutes make one Hour, 24 Hours make one Day, 7 Days make one Week, 4 Weeks make one Month, 13 Months, 1 Day, and 6 Hours make one Year Julian; or that Year which is observed by us in England.

Q. What's the Decimal of 271 19 15 50 a Year being

the Integer ?

A. These reduced into Seconds are 23483750, which divided by 31557600 the Seconds in a Year, gives the Quotient .74415513, the Decimal sought.

### Of MOTION.

The denominative Parts are Circles, Signs, Degrees, Mi-

nutes, Seconds.

That is 60 Seconds make one Minute, 60 Minutes make one Degree, 30 Degrees make one Sign, 12 Signs make one Circle in the Zodiack, or the Circumference of the Heavens.

B 4 2. What's

2. What's the Decimal of 23 19 56, a Gircle being the

Integer?

A. These reduced into Seconds are 83996, which divided by 1296000 the Seconds in a Circle, give in the Quotient .064811, the Decimal sought.

### Of FOOT MEASURE.

The denominative Parts are Feet, Inches, Parts.

That is 12 Parts make one Inch, 12 Inches make one Foot.

2. What's the Decimal of \( \frac{1}{4} \) of an Inch, a Foot the Integer?

A. It is this Compound Vulgar Fraction \( \frac{1}{4} \) of \( \frac{1}{12} = \frac{1}{48} \).

48)1.000000(.020833

Q. What's the Decimal of  $3\frac{1}{4}$  Inches, a Foot the Integer? First,  $\frac{1}{4}$  is  $\frac{1}{4}$  of  $\frac{1}{12}$ , and 3 is  $\frac{3}{12} = \frac{1}{4}$ , which two Fractions, wiz.  $\frac{1}{4}$  of  $\frac{1}{12}$ , and  $\frac{1}{4}$  added together according to the Rule of Addition of Vulgar Fractions make  $\frac{5}{192}$  which I reduce into a Decimal as has been taught above.

192)52.00000000(.27083333

By the above Method I calculated the following Table.

This Table is placed upon one of the Sides of Verie's Sliding Rules.

A Table of the Decimal Parts of a Foot.

Inches	Decimal Parts	Inches	Decimal Parts	Inches	Decimal Parts
14 12 34 1.	.02083333 .04186666 .0625	14 12 34 5.	.35416666 .375 .39583333 .41666666	14 12 34 9.	.6875 .70833333 .72916666
1 4 1 2 3 4 2.	.10416666 .125 .14583333 .16666666	6.	.4375 .45833333 .47916666	14 12 34 10.	.77083333 .79166666 .8125 .83333333
14 12 34 3.	.1875 .20833333 .22916666	7.	.52083333 .54166666 .5625 .58333333	14 12 34 11.	.85416666 .875 .89593333 .91666666
1411234	.27083333 .29166666 .3125	14 12 3 4 8.	.60416666 .625 .64583333 .66666666	1/2	.9375 .95833333 .97916666 Integer.

To find the Value of a Decimal Fraction in the know Parts of Money, Weight, Measure, Time, &c.

The RULE.

Multiply the given Decimal by the Denominative Parts of the Thing of which it is a Fraction, and cut off towards the Righthand of the Product so many Places as the given Decimal contains, and those on the Left-hand are the Value of the given Decimal; and if any thing remain it is the Decimal of an Integer in the Denomination last found, which must be brought to the lowest Name mentioned: A few Examples will make the Thing plain to the meanest Capacity.

Quest. What's the Value of this Decimal .0125 of a Pound

Sterling. See the Work.

1. .0125 20 Shillings .2500

Answer. Pence 3.00

As often as Cyphers fall on the
Right-hand of
your Work, afways drop them;
for they have noe
any manner of
Signification.

2. Example. What's the Value of this Decimal .95 of a Pound Sterling?

1. .95 20

Answer. Shillings 19.00

3. Example. What's the Value of this Decimal .0375 of a Pound Sterling?

2. .0375 20 Shillings .7500

Answer. Pence 9.00

4. Example. What's the Value of .528125 of a Pound Sterling?

.528125 20 Shillings 10.562500

Pence 6.7500

Farthings 3.00

Anfav. 101. 6d. 39.

A Compendi-ous Method of finding the Value of a Pound Sterling: The first Figure in the Place of Primes, is, of the Decimal of when doubled, so many Shillings, and the other Figures are Fara Pound Sterling. things, only observe that for every 25 to cast away one Farthing.

Example. Let .4862 be the Decimal Part of a Pound, and its

Value required?

First, The 4 in the Place of Primes being doubled is 8 s. and because the 8 is more than 5, I take away 5, and for it add one Shilling to the 8 s. and that make it 9 s. and the remaining Figures are 362; but you may omit the last Figure to the Righthand; then because there is but one 25 in 36, I call 36 but 35 Farthings, which is  $8 d. \frac{3}{4}$ , so the Value of the given Decimal is 9 s. 8 d. 3. The like observe of any other Decimal of a Pound Sterling.

Example 2. 2. What's the Value of .933593 of a Barrel of

Ale ?

-933593 1867186 2800779 Gallons 29.874976 Quarts 3.499904

Pints .999808 nearly 1 Pint. For it is nine hundred, Ninety-nine thousand, eight hundred and eight Million-Parts of a Pint.

Example 3. 2. What Part of a Foot is .27083333?

.27083333 Inches 3.24999996 Parts 2.99999952

i. p.
Answ. 3 2.99999952 That is nearly 1 of an Inch.

### CHAP. III.

#### ADDITION of Decimal Fractions.



HIS is the very fame with Addition of Whole Numbers of one Name or Denomination, but you must observe to place Primes under Primes, Seconds under Seconds, &c. whether they be Cyphers or fignificant Figures, and when the Work is done, make a Prick or Dot with your

Pen between the whole Number (if there be any) and Decimal Fraction, which is known by pricking off so many Places to the Right Hand as your greatest Decimal Fraction contains: see the following Examples, which will make all plain.

Fractions.	Mixt Number
.7403	3758.14
.04681	2164.927
.904283	1791.2063
.12305	1480.07352
.3197	1365.0067896
.8	10.0004

Sum 2.934143 Sum 10569.3540096

The Sum of the Fractions amounts to two whole, and 934143 Decimal Parts of the Integer; for in the greatest Fraction there are Six Places, and therefore I cut off Six Places to the Right Hand of the Sum: But in the mixt Number the greatest Fraction consists of seven Places, for which Reason I cut off seven Places to the Right Hand of that Sum.

	Examples of	of Mo	oney.
1.	l. s.	. d.	9.
87.1246	C87 2	5	3.616
72.82574	are 72 10	5 8	2.3104
62.25	012 62	, 0	0.
57.716	to 57 14	1 3	3.36
43.3	43 6	0	0.
34.628458)	C34 12	6	3.31968
357.854798	357 17	1	0.60608
20			

Shil. 17.095960 12 Pence 1.15152

Farth. .60608 agreeing exactly with that on the Right Hand.

Ale-Measure. The Method of casting up an Excise-Book, charg'd on a Country Victualler.

	16	l 3	E	1 1	/I.	Cy	der.
	Days	В.	G.	B.	G.	H.	G.
1737 August September	17 23 25 29 2 5 8 10 14	17 ½ 20 ¼ 12 ¾ 10 ¼ 8 ¾ 14 ¼ 10 ½ 18 ¼	7. 8 3. 5 8. 4 5. 7 6. 6 2. I 7. 8 3. 9 5. 5	98 4 5 7 6 5 4 7 6.	3. 4 6. 5 7. 8 3. 9 8. 9 2. 1. 1 3. 3 3. 8	15 14 18. 12 12 3 14 7 12 8 14 16 14 10 12 6 3	12. 7 14. 3 2. 1 6. 8 15. 11. 3 7. 9 12. 4 10. 5 4. 6
Odds * Caleb Bono	- /	1 1 2	4° - 7	$\frac{1}{4}$ $\frac{4}{64}$	3. 4	$\frac{1 \frac{1}{2}}{121}$	4. 6
Carried forward		3,400	4. 5	1.	3.6	100 m	3. 1

Note, These three Dividends are the Sum of each respective Column under G: which are divided by a fourth of a Barrel and one fourth of a Hogs-head.

3£ or Strong.  
8.5)55.5(6=
$$1\frac{1}{2}$$
  
VI. or Small.  
\*8.5)46.1(5= $1\frac{1}{4}$   
42.5  
3.6  
Cyder.  
15.75)97.6(6= $1\frac{1}{2}$   
94.5

Explanation. The Entry above we suppose to be an Excise Man's Book, who surveys a Country Victualler; in which the first Column expresses the Days of the Month, when the Charges were made, the next two Columns under B, G, are Barrels, and Quarters of Barrels, Gallons, and Decimals of a Gallon of Strong, which is signified by 32. The next two Columns under v1. are Barrels, and Quarters of Barrels, and Gallons of small Beer. The next two Columns under Cyder, are Hogsheads and Gallons of Cyder. To add up which, consider that 34 Gallons are a Barrel both of strong and small Beer, one Fourth of which is 8.5 Gallons. And Cyder is gaug'd by the Wine Gallon, 63 of which make an Hogshead; and one fourth of that is 15.75 Gallons. Then casting up the Cyder Gallons and Tenths, I find the Sum 97.6 Gallons, which divided by one fourth of a Hogshead, viz. 15.75 the Quotient

is 6 Quarters of Hog sheads, or 1 1 Hog shead is put in the Column under H. The same Order is observed in casting up the frong and small Beer; fo that there are Odds 1 1 Barrel of frong that comes from the frong Gallons, 1 4 of small and Barrels of small and 121 Hog sheads of Cyder. The strong pays Ex. the Excise Books cise 5s. and the small 1 s. 4 d. per Barrel; and the Cyder 10s. 8d. per Hogsbead; so that the Excise of the Ale comes to 32 1. 155. the small to 4 l. 9 s. and the Cyder to 64 l. 10 s. 8 d. All which in one Sum make 101 l. 14s. 8d.

#### CHAP. IV.

#### SUBSTRACTION of Decimal Fractions.



HIS is the very fame with Substraction of whole Numbers of one Name or Denomination, observing to place Primes under Primes, Seconds under Seconds, &c. as has been taught in Addition. And when that is done, you must take care to distinguish the Fractions from the whole Numbers

(if any) by cutting off with a Prick or Dot, as many Places to the Right Hand of the Remainder as are in the greatest Fraction : and when you substract a Fraction from a whole Number, you must add as many Cyphers (or suppose them to be added) to the whole Number as there are Decimal Places in the given Fraction. The following Examples will make this plain.

From Take	Fractions48 /	a Mixt Number 586.
Remains	.205	585.27155

In substracting Integers and Decimals observe the following Order.

Lent 1730.027 } are e { Paid 1681.8352 } qual to {	1730	s. d. q. o 6 1.92 16 8 1.792	
Rem. 48.1918	48	3 10 0.128	-
Shillings 3.8360			
Pence 10.032			

.128 Agreeing exactly with that on the Right Fartbings Hand; for you see the Decimal . 1918 of a Pound is equal to 3 s. 10 d. 0 q. .128.

### Multiplication of Decimals. Part I.

In fubstracting of Barrels, Gallons, and Decimal Parts, as it is used in the Excise, observe the following Method.

	Stron	12.	Sm	all.	C	yder.
	B.	G.	B.		H.	gder. G.
Bought	414	4.2	171	5.6	601	10.4
Sold	291		131		The state of the s	12.8
Rem.			3 3 4			13.35

In Addition you carried 8.5 in the Strong and Small from the Gallons and Decimal Parts, to the Fourths of a Barrel, and in the Cyder 15.75: And here you must borrow the same Quantities, when you cannot otherwise substract. As in the Strong, I cannot take 7.8 out of 4.2, therefore I borrow a quarter of a Barrel which is 8.5, and add it to 4.2; Which makes 12.7. From this take 7.8, and there remains 4.9. The same is to be observed in the other Examples.

#### CHAP. V.

Multiplication of Decimal Fractions.

ULTIPLICATION of Decimals is the very fame with that of whole Numbers in all Respects, whether both the Factors + be Decimal Fractions or whether they be mixt Numbers; only when the Work is done, all the Matter is to distinguish the true Product, which is always known by cutting off to the Right-Hand of the Product so many Places, as you have decimal Places in both the Multiplicand and Multiplier; but if the Product doth not produce so many Places, then that Defect must be supplied by placing so many Cyphers on the Left-hand the Product, as will make the Places equal to those in both Factors.

How to find at the true Pro-

Here are three Cases, which mark well.

Cafe 1.

Cas	
	lied by a Decimal Fraction.
Multiplicand .864	.4078
Multiplier .432	.2039
1728	36702
2592	12234
3456	8156
Product .373248	.08315042

CASE 2.

The Multiplicand and Multiplier are called Factors by several Arithmeticians

A De Multiply By	cimal Fraction .864 4-32	Case 2. multiplied And By	by a Mixt .4078 20.39	Number
	1728 2592 3456		36702 12234 8156	
Product	2 72248		8.215042	

Cafe z.

Cafe 2.

A Dec Multiply By	imal Fraction m	ultiplied by And By	a Whole .4078 2039.	Number
	1728		36702	
2592 3456		12234 8156		
Product	272 248	8	21.5042	

Tho' I have made use of the fame Figures throughout each of these three Examples, yet the Reader will find the Value of the Products to be very different.

### CONTRACTIONS in Multiplication of Decimals.

IT frequently happens in Business, that one or both the Factors consult of many Decimal Places, viz. of 12, 14, or sometimes more; so that to work them all would be very troublesome, and when done but little to the Purpose; because a fewer Number of Places may do the Business as well: Therefore the following Method was invented.

The RULE.

1. Transpose all the Figures of the Multiplier in a contrary Order to the common Way; viz. Let the Unites Place stand to

the Left-hand.

2. The Unites Place of the Multiplier must stand under that Place of the Multiplicand, whose Decimal Place you intend

to retain in the Product.

3. Begin as in common Multiplication, always having regard to the Increase of that Figure on the Right Hand, the Figure which stands over your Multiplier; making use of no more Places of your Multiplier than what stand even with your Multiplicand to the Left-hand: The following Examples will make this plain.

Let it be required to multiply 3.14159 by 24.8253, and to have four Decimal Places in the Product of the first Operation, three in the second, two in the third, and one in the

fourth 3

1. 3.14159 352842	3.14159 352842	3. 3.14159 352842	4. 3.14159 352842
628318	62831	6283	628
125663	12566	1256	125
25132	2513	251	25
628	63	6	-
157	16		77.8
9		77.96	
77.9907	77.989	12 (	** * **

You see in the 4th Operation I take no more of the Multiplier than the 8 which flands even with the Multiplicand, the 3, 5 and 2 are drop'd, in the 3d the 3 and 5, in the 2d the 3 only is omitted: But in the 1st Operation all the Multiplier is taken in.

There are many pretty Questions in Multiplication of Decimals, to which several true Answers may be produced according to what is put for the Integer: As 3 s. 11 d. squared, a Pound being the Integer: The Answer will be 9 d. 0.816541 q; but if you make a Shilling the Integer, the Answer will be 15 s. 4 d. 0.333 q.—So likewise if 1 s. 6 d. be squared, a Pound being the Integer, the Answer will be 1 d. 1.4 q: But put a Shilling for the Integer, the Answer is 2 s. 3 d. & c.

### CHAP. VI.

### DIVISION of Decimal Fractions.



OU are to proceed in every Respect, as if the Fractions were whole Numbers, tho' it may happen that the Dividend thall be less than the Divifor; and in this Case add as many Cyphers to the Dividend as you think you shall want, and the Cyphers thus added must be reckoned as Decimals;

when this is done, the Difficulty is to know the true Value of the Quotient; which is always found by this

#### RULE.

1. Substract the Number of Decimal Places in the Divisor, from the Number of Decimal Places in the Dividend, and the Remainder is the Number of Decimal Places that you are to cut off to the Right-hand of your Quotient for Decimals, and those on the Left (if any) are whole Numbers.

2. But when it happens that the Quotient does not contain for many Places as the Excess of Decimal Places of the Dividend above those of the Divisor, this Desect must be supplied by adding so many Cyphers to the Lest-hand of your Quotient as will make up that Excess. See this done in the 4th Case sollowing.

3. Further

3. Further, Note. When you divide a whole Number by a whole Number, if any thing remains, add Cyphers to that Remainder, and divide as far as you please; so will you have a Decimal in the Quotient of as many Places as you added Cyphers, and the whole Quotient thus found will be a mixt Number.

4. There are NINE Cases, which take in the following Order; in which I shall make use of the same Figures, in both Divisor and Dividend, by which the Learner will be easily let into the

true Notion of the Ground and Nature of Decimals.

CASE I.

Given, a whole Number to be divided by a whole Number. 579268.)314159205.(542.33827

A whole Number by a whole Number.

N. B. Here five Cyphers were added to the Remainder, which produce five Decimal Places in the Quotient.

The Operation. 579268.)314159265.00000(542.33827

> > CASE 2.

Given, a whole Number to be divided by a mixt Number. 579.268)314159265.0000(542338.3

A whole Number by a mixt Number.

Here, you must add three Cyphers to the Right Hand of the whole Number in the Dividend, and then the Quotient will be a whole Number; and because there is a Remainder, you may go on again by adding Cyphers at pleasure; so the Quotient will be a mixt Number.

CASE 3.

Given, a whole Number to be divided by a Decimal Fraction. .579268) 314159265.000000 (542338373.

A whole Numi by a Decimal Fraction.

Part I.

A mixt Numbet by a whole Number. C A S E 4. Given, a mixt Number to be divided by a whole Number. 579268.)3.14159265(.00000542

A mixt Number by a mixt Number. C A S E 5.

Given, a mixt Number, to be divided by a mixt Number.
57.9268)3.14159265(.0542

A mixt Number by a Decimal Fraction. Given, a mixt Number to be divided by a Decimal Fraction.
.579268)3.14159265(5.42

A Decimal Fraction by a whole Number. Given, a Decimal Fraction to be divided by a whole Number, 579268.).314159265(.00000542

A Decimal Fraction by a mixt Number. Given, a Decimal Fraction to be divided by a mixt Number. 5.79268).314159265(.0542

Given, a Decimal Fraction to be divided by a Decimal Fraction.
.579268).314159265(.542

A Decimal Fraction by a Decimal Fraction.

Note. In all the above nine Cases, except the first, I have purposely omitted the Operations at large to exercise the Learner, and to try his Ability.

Mukiplication and Division infallibly prove each other; and if you have a mind to do any Mukiplication Sum, by Division, or any thing in Division by Multiplication, divide an Unite with Cyphers annexed by the given Multiplier; and the Quotient is the Divisor, by which, if you divide the given Multiplicand, that Quotient will be equal to the Product, &c.

Again, if you divide an Unite by your given Divisor, this Quotient will be a Multiplier; by which if you Multiply the given Dividend, the Product shall be equal to the Quotient of that Dividend, when divided by its proper Divisor.

### Of dividing Decimals a much shorter Way.

Because the Way of dividing Decimals often proves tedious, when it is required to continue the Division till the Value of the Remainder be small; therefore the following Rule was invented.

1. The first Figure in the Quotient must be of the same Name with that Figure in the Dividend, which stands (or is supposed to stand) over the Unite's Place in the Divisor.

2. By knowing the Value of the first Figure in the Quotient, you may have as many or as few Places of Decimals as you please, by taking so many of the Lest-band Figures of the Divisor as you will for the first Divisor, and then take as many Figures of the Dividend

Dividend as will answer them; and in dividing omit one Figure of the Divisor at each Operation: A few Examples will make this plain. Let it be required to divide the mixt Number 3.14159265 by the mixt Number 57.9268 and to retain four Decimal Places.

Now because the 7 in the Unite's Place of the Divisor falls un-

Now because the 7 in the Unite's Place of the Divisor falls under the 4, or second Decimal Place of the Dividend, I see (according to Rule 1 above) that there must be a Cypher to the Left-

hand of the first Decimal Place in the Quotient.

Example 1.

Tho much Labour be faved by this Method, yet it is not proper to use it, unless the Decimals in the Dividend contain many Places; and then take all the Divisor and work as above is taught.

When you cannot have the Divisor, drop a Figure in the Divisor, which is done by putting a Dot under it; then with the Remainder of the Divisor proceed to divide the rest of the Divisors.

as you may fee by the Work.

Example 4.

579268).3141592 | 65(.000000542

2896340
245252
231707
13545
11585

C 2 As

I call the Divisor no more than 57-92 and the Dividend but 3.1415, having regard to the Increase of the Figures in the Divisor left out.

# Contraction of Decimals.

As in Multiplication, so here in Division many Questions may be proposed, and diverse Answers to the same Question according to what is made the Integer. As suppose 6 d. be divided by 6 d. a Pound the Integer, the Quotient will be 1 l. and if 5 s. 3 d. 3 be divided by 15 s. 9 d. 3 the Quotient will be 6 s. 8 d. 2.5312 g. but if a Shilling be the Integer the Quotient will be 4 d. 0.1268. q.

### CHAP. VII.

Of the fingle Rule of Three Direct, in Decimals.



N this Rule there are always three Numbers given to find a Fourth, which bears fuch Proportion to the Third, as the Second doth to the First.

1. Observe always to put the Number that implies the Demand in the Third Place.

2. The First Number must be as the same Name with the

3. Multiply the Second Terms together, and divide that Product by the First, and the Quotient is the Answer to the Question; which will always be of the same Name with the second Number.

Example. If 12 1 Yards of Cloth coft 15 s. 9 d. what will 48 Yards cost at that Rate, a Pound being the Integer?

> You must State it thus. Yards Yards 1.

1. s. d. q:

Part I.

If 12.5: .7875::48.25, Answer, 3 0 9 2.16.

Secondly. If in the same Question we make a Shilling the Inteter, it will stand thus.

Yards Yards 1. 1. s. d. q. If 125: 15.75:: 48.25. Answer, 3 0 9 2.16.

Question II. If for 2 l. 5 s. 6 d. 1 I buy 2 1 Barrels of Ale, how many Barrels may I buy for 50 l. 10 s 3 d. 3, a Pound being the Integer ?

If 2.27604167: 2.5:: 50.515625, Answer 55.486.

The same Question answered by putting a Shilling for the Integer, it will stand thus.

If 45.520833: 2.5::1010.3125. Answer 55.486 as before.

It is needless in this Place to say any thing of the Inverse. or any other Proportions, because they are of no Use here; and when I come to treat of the Use of the Sliding Rule, you will find them fufficiently explained.

### CHAP. VIII.

Of the Extraction of the Square Root.

1. XXXXIII of the	
Square - Root, is A	
E the finding a	
Number which be	
ing multiplied by	1-10-
itself once, gives the respective	25
Power out of which the Root is to	
be extracted: as if 25 be proposed	
to be extracted, you will find its	
Root to be 5, for 5 Times 5 is 25;	

doy 34 q.

to

2-

ne

r. 8 and this is Geometrically demonfirated by the Figure in the Margin, where each Side contains 5 equal Parts, by which the great Square ABCD is divided in to 25 little Squares.

2. This Table of the Square of the nine Digits with their Roots must be got by Heart.

Squares	1	4	9	16	25	36	49_	64	81
Roots.	1	2	3	4	5	6	7	8	9

3. Now to find out the Root of any Square proposed: set down your Number, then draw a crooked Line on the Right-hand thereof, in which set every Figure of the Root distinctly; then begin at the Unite's Place of a whole Number, over which put a Dot, and so over every other Figure to the End of the Square Number to be extracted; and so many Dots as there are, so many Figures you will have in the Root.

4. This done, fee what is the nearest Square less than the first Period towards the Lest-band of your Square Number, and whatever you find it to be place it in the Quotient, or Root; Square the Root, (that is, multiply it by itself) and set it under the first Square; draw a Line and substract; to this Remainder bring down the next Period or Pair of Figures; double the Root and place it on the Lest-band for a Divisor, then see how often the Divisor can be had in the Resolvend, (excepting the Figure to the Righthand;) and as often as you find it will go, place it in the Root, and also in the Unite's Place of the Divisor; multiply the last Root by the Divisor, and place the Product under the Resolvend; continue thus till all the Periods or Square Numbers be brought agwn. And if any thing Remain, add two Cyphers, and work as

has been taught above; and for every two Cyphers thus added there will be one Decimal Place in the Root.

Example, I. Let it be required to Extract the Square-Root of 2401?

2401(49 Root. 16 89)801 801

Here are four Cyphers added, which give two Decimal Places in the Regt.

Example II. 814602573.0000.(28541.24 48)414 384 565)3060 2825 5704)23525 22816 57081 )70973 57081 570822)1389200 1141644 5708244)24755600 23892576 Remains 922024

Proof of the Work.

If you fquare the Root, and to that Product or Square add the Remainder (if any) that Sum shall be equal to the Square Number first given.

To extract the Root of a mint Square. Example III. What's the Square-Root of 436.5?

When your Number of Decimal Places are odd as here, you must ever make them even by adding Cyphers, as 0,00,00,00, & c. to the Right-hand of the given Square, that so the Dot may fall over the Unite's Place of the whole Number.

I.

lded

of

See the Work.

Example IV. Let the Square-Root of 80 be fought?

Operation.

800000000000.(8.94427 Root.
64
169) 1600
1521
1784) 7900
7136
17884) 76400
71536
178882) 486400
357764
1788847)12863600
12521929

A Surd whole Number given to be extracted.

In this Work I have added 10 Cyphers; fo there is in the Root five Decimal Places; and when so done there is a Remainder of 341671.

C 4

CHAP.

A Surd Number is that which is not a true Square Number, that is, whose Root cannot be exactly found; tho' by adding Cyphers as above you may come infinitely near the Truth, as is \$0 in the above Example.

### CHAP. IX.

Of the Use of the Square Root.



HE Square Root is of excellent Use in most Parts of the Mathematicks; but more especially in folving of Arithmetical and Geometrical Questions, which I shall exhibit as follows.

1. To find a Geometrical mean Proportional between any two given Numbers.
The RULE.

Multiply the two given Numbers together and extract the Square Root of the Product, which gives the Answer fought.

Example I. What's the Geometrical mean Proportional between 4 and 6?

Here four Cyphers added, give two Decimals in the Root.

Example II. What's the Geometrical Mean between 20 and 30? Answer 24.49.

2. To find the Diameter of a Circle which shall be equal in Area + to an Ellipsis whose Transverse and Conjugate Diameters + are given.

The RULE. Multiply the two Diameters of the Ellipsis together; and the Square Root of that Product is the Diameter of a Circle equal.

Example. Let the Transverse Diameter of an Ellipsis be 36, and the Conjugate 23.5, what's the Diameter of a Circle equal?

The Area of a Circle is the same with superficial Content.
If The Transfeerse Diameter is the longest, and the conjugate is the shortest Diameter in any Ellipsis, cutting each other in the Center.

3. Any two Sides of a Rect-Angled Triangle being known, the By the 47th of third may be easily found. By which, having the Bung and the first Book of Head DIAMETERS of a Cask given, we can find the DIA-ments. GONAL Line, et contra.

### The RULE.

Add the Square of half the Sum of the Head and Bung Diameters, to the Square of half the Length, the square Root of that Sum is the Diagonal of that Cask.

Example. Let 25 be the Bung, 22 the Head Diameter, and 30 Inches the Length of a spheroidal Cask; What's the Dia-

gonal Line?

Note. The Contents of this Cask in Ale Gallons is 48.3, and in Wine Gallons 58.9, as will be shewn in its proper Place,

4. The Area of a Triangle, Circle +, &c. given to find

the Side of a Square equal.

5. The Side of a Square given to find the Side of another Square that shall be 2, 3, 4, &c. times greater or leffer than the given Square.

6. Given the Diameter of a Circle to make another 2, 3 or

4 times greater or leffer than the given Circle.

Admit

All Circles are proportioned one to another as the Square of their Diameters.

lity.

# Ale of the Square Root. Part I.

Admit a Pipe of Lead being 1.5 Inch Diameter will fill a Ciftern in two Hours; I demand the Diameter of another Pipe that will fill the same Ciftern in one Hour?

The Rule.

Multiply the Square of the Diameter by 2, and the Square Root of that Product is the Answer.

Operation	•	
1.5		
1.5		
75		
15	(	
2.25		
2		
4.50(2.12	Inches is the A	<b>swer</b>
4		
41)50		
41		
422)900		
_844		

An Example where the Solution is purposely Rope or Cable, to find the Weight of another Cable whose comitted to try the Circumference is also known.

The RULE.

As the Square of the Circumference of the Cable given, to the Weight of one Fathom, or any Part thereof; so is the Square of the Circumference of the Rope required, to the Weight of one Fathom, or any Part thereof.

8. Given the three Sides of a right lin'd TRIANGLE, to

find the Area or superficial Content.

The RULE.

Add the three Sides together, and from half the Sum, fubfiract each Side severally; then multiply the half Sum into all the three Differences: The Square Root of the last Product is the Area required. Euclid. 12.2.

In Questions of 9. Given, the Reckoning spent by a Company of Persons, to this Nature, the find out the Number of Persons, and what they spent a piece.

Number of Persons.

fons is always
equal to the Sum
Reduce the whole Reckoning into its lowest Name, and exwhich they spent tract the Square Root of it, which gives the Number of Persons,
per piece.

and what they spent per piece, which is always of the same
Name you reduced the Sum into.

10. The Square Root is also useful in embattling of Soldiers in an Army; which being foreign to our present Design, I forbear to speak of it in this Place.

The Reason The Cube Root being of no Use in Measuring, and in why the Cube Gauging, only for calculating Diagonal Lines; I say no more

Roorisnot taught of it, till I shew its Use upon the Sliding Rule.

CHAP.

### CHAP. X.

A Description of the Sliding Rule +. (See Plate A, facing the Title Page.)



HIS Instrument is commonly made of Box, and fometimes Ivory, exactly a Foot long, 1.2 Inch broad, and \( \frac{3}{4} \) of an Inch thick. It confifts of four Parts, viz. A Rule, and three small Scales or Sliding-pieces fitted nicely with Grooves to flide in it.

The first marked B N, to slide by the Line A, the second mark'd C D, to flide between the Lines D and E, and the third mark'd N, slides in the Edge of the Rule between the two Segments of a Circle: so that when the Sliders B and C are drawn out to their full Extent, the whole Rule will be three Foot long.

# Of the first Face of the Rule.

1. On the first Face of this Instrument are placed four Lines of Numbers \*; the first Line of Numbers confists of two Radius's ||, and is numbred 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and then 2, 3, 4, 5, 6, 7, 8, 9, 10.

On this Line are placed several Brass Center Pins, The first in the first Radius at 2150.42, and the third likewise at the same Number taken in the second Radius, having M B set to them, fignifying that the aforesaid Number represents the cubic Inches in a Malt-Bushel. The second and fourth Center Pins are fet at the Number 282 on each Radius; they have the Letter A fet to them, fignifying that the aforesaid Number 282 are the cubic Inches in an Ale Gallon. And the W on the Line B stands at 231, being the cubic Inches in a Wine Gallon: you see it is placed both in the first and second Radius, the C in the same Line being placed at 3.14, which is the Circumference of a Circle whose Diameter is Unity,

The fourth Line, on the first Face, is a broken Line of Numbers of two Radius's numbered 2, 1, 9, 8, 7, 6, 5, 4, 3, 2, 1, 9, 8, 7, 6, 5, 4, 3. The Number 1 is set against M B of the first Radius of the Line A; this Line of Numbers hath M D fet to it, fignifying Malt-Depth. Note, The little long black Dots over the Center Pins are put directly over the proper Numbers. This Line of Numbers hath A placed at the End thereof, and is called A for Distinction's Sake.

2. The

Fig. 1.

Fig. 2.

Fig. Is

This Rule was first invented by Thomas Everard, Esq. in the Year of our Lord 1683, and made by Isaac Carver of Horsleydown, near London. But the Rule which I now describe is an Improvement on Everard's, mentioned by me in the 9th and 10th Editions of Everard's Gauging. Everard was then Officer in the Excise at Southampton. See the first Edition of his Book.

Mr. Gunter was the first who made the Line of Numbers from the Logarithms, il Radius fignifies the Semi-Diameter or Half-Diameter of a Circle.

2. The fecond and third Line of Numbers which are on the See the Menfusation of a Circle Sliding Piece B N (and which may be called but one Line) Work where you are exactly the same with the first Line of Numbers: The have these Num-little black Dot that is near the Division 7, on the first Rabers at large. dius, having Si set after it, is put directly over . 707, which is the Side of a Square inscribed in a Circle, subose Diameter is Unity. The black Dot near unto the Figure 9, after which is writen Se +, is fet directly over .886, which is the Side of a Square equal to the Area of a Circle whose Diameter is Unity.

### Of the second Face of the Rule.

Fig. 2. How these found and used, will be shewn in . the following Work.

3. The fecond Face of the Rule has one fingle Line of Numbers mark'd D, and numbered 1, 2, 3, &c. to 10. The Gauge Points are Line C (on the Slider) is a double Line of Numbers of the same Length with the fingle one D; and by this on the Slider is the fingle Line of Numbers D again repeated, which answers to the Square and Cube Roots of the Lines C and E. The W G on the Line D being placed at 17.14 is the Gauge-Point for Wine; and A G placed at 18.94 is the Gauge-Point for Ale Gallons. The MS which stand at 46.37 is the Gauge Point for a Malt-Bushel in Square Measure: And the MR being placed at 52.32 is the Gauge-Point for a Malt-Bushel in round or circular Measure. The TP which stand at 6.32 is the Gauge Point for a Pound of Tallow neat. Line marked E, on the second Face of the Rule, is a Triple Line of Numbers, and is numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 1; which I stands for 10, the next Line being number'd 1, 2, 3, &c. to 10, which stands for 100, the third Line being number'd 1, 2, 3, &c. to 1000, having Eafter it, and therefore is called the Line E for Distinction sake; its Use is to find the Cube Root of any Number, and to calculate Diagonal Lines for any Measure or Cask whatsoever.

4. The Two Lines of Numbers which are on the Sliding Piece marked C, are exactly the same as on the Sliding Piece on the other Side the Rule. There is placed (upon some Rules) a black Dot at .0795 which is the Area of a Circle when the Circumference is Unity: And another black Dot at .785 being the Area of a Circle when the Diameter is Unity.

# Of the third Face (or Edge) of the Rule.

On one Edge of the Rule are placed two Lines of Segments of a Spheroidal Cask, each numbered 1, 2, 3, &c. to 100; the first is for finding the Ullage of a Cask, taken as the middle Frustum of a Spheroid, lying with its Axis parallel to the Horizon, noted with Seg. Ly. and the other for finding the Ullage of a Cask standing, as noted with Seg. St. Between these two Segments slides a Line of Numbers with a double Radius marked at the end with N; and at each end of the Slider there is a

The two Gauge Points S.i and S.e, are sometimes put upon the Rule, and sometimes

Brass Stud for Conveniency of moving them too and fro with your Thumb.

# Of the fourth Face (or Edge) of the Rule.

5. On the opposite Face of the Rule, is placed a Line of Inches Fig. 4 to 12 decimally divided: next to this lyeth a Line numbered with 1, 2, 3, &c. to 7, and at the End marked with a Spheroid; by help of which is found a mean Diameter for a Cask, in the Form of the middle Frustum of a Spheroid. Next under this, is a Line for finding the mean Diameter of a Cask in the Figure of the middle Frustum of a parabolic Spindle, which by Gaugers is called the second Variety of Casks; it is numbered 1, 2, 3, 4, 5, 6, and at its End is writ 2d Variety. Next under this lyeth a Line, by means of which is found the mean + Diameter of a Cask of the third Variety; that is, a Cask in the Figure of two parabolic Conoids abutting upon a common Base: it is numbered 1, 2, 3, 4, 5, and at the End thereof is writ 3d Variety. \*

# Of the three Sliding Pieces.

6. The above are all the Lines on the four Sides of the Rule ; but Fig. 5 and 6. on the Backfide of the two Sliding Pieces is a Line of Inches from 13 to 36, when the two sliding Pieces are put end-ways together; and against that the corresponding Gallons or hundred Parts, that any small Tub, or such like open Vessel (from 13 to 36 Inches Diameter) will contain at one Inch deep: its Construction will be shewn in its proper Place. These are commonly called (by Gaugers) the Ale Areas. And by drawing out the Of the Use of first Slider, any open Vessel's Diameter under 24 Inches may be the Sliders. taken, and its Area in Ale Gallon is shewn by Inspection: if the Tub be more than 24, and less than 36 Inches Diameter, then pin the first Slider fast, and draw out the other Slider, and you have the Diameter in Inches and Decimal Parts of an Inch of that Tub, with the Ale Area answering to that Diameter by Inspection.

The Inside of the little Slider marked N. O, is for reduc- Fig. 7. ing Casks in the Form of the Frustum of a Cone, to a Cylinder; as suppose the Difference between Head and Bung, of a Cask

† That is a Diameter which reduceth the Cask into a Cylinder; which Diameter is always more than the Head, and less than the Bung Diameter.

\* Mr Verie sometime a Collector of the Excise, made an Alteration in Everard's Sliding Rule; so that the whole Length of one Foot contained but one single Radius of the Line of Numbers, and both Sliders do work together on one Side of the Rule in every Operation; by which Contrivance the Divisions in this Rule, are twice as large as on those first made by Mr Everard. And on the narrow Face of this Rule of Mr Verie's, is a Foot divided into 100 equal Parts, every ten of which are numbered; FM stands at the Beginning of it, signifying Foot Measure. Under this is a Line of Inches, each being divided into ten equal Parts, having I M at the End thereof, signifying Inch Measure. Next to this is a Line for sinding the mean Diameter for the sourth Variety of Casks, which is the middle Frustum of two Cones abutting upon one common Base. It is numbered 1, 2, 3, 4, 5, 6, and at the End thereof is writ FC, signifying Frustum of a Cone.

be 5.3, feek this in the Line of Inches, and against it you will find 3.4, which add to the Head Diameter, and it-reduces the Cask to a Cylinder.

# How the Lines on the Sliding Rule are made.

1. All the Lines of Numbers above described are made by one General Rule, which is this: Get a Plate of any good Metal, as Brass, Copper, &c. of what Length you design your Line to be, and thereon draw three parallel Lines, for the better distinguishing the Divisions of the Line of Numbers, and make a Mark for the Beginning of it. Close by these three parallel Lines, draw ten other parallel Lines, and divide this into 10 equal Parts; one of which subdivide into 100 equal Parts, which makes it a Diagonal Scale of 1000 equal parts: being thus prepared, look into the Table of Logarithms + for the Number 200, and against it you will find the Logarithm 2.301030: rejecting the Characteristick 2, and also the three last Figures to the right Hand 030, because the Length of the Radius is divided but into 1000 equal parts; take 301 (from your Diagonal Scale) in your Compasses, and lay off that Distance from the Beginning of the Line of Numbers, and there place the Figure 2 for the first Prime. Again to find the Division for the second Prime, look into the Table of Logarithms for the Number 300, and you will find its Logarithms to be 2.477121, reject the Characteristick 2, and also the three last Figures to the Right Hand, and take in your Compasses from your Diagonal Scale (as before) the Number 477, and lay off that Distance from 1, at the Beginning of the Line of Numbers to 3 for the second Prime: and so by proceeding thus you will compleat all the Prime Numbers of one Radius, of your Line of Numbers: and for your better Help I shall here insert the Logarithms, with the Numbers themselves that are to be taken from your Diagonal Scale.

	( 200)		(2.301030	)	(30i
	300		2.477121		477
	400		2.602059	Numbers	602
	500	T	2.698970	to be ta-	699
Numbers 5	600	Loga-	2.778151	ken from	778
The state of	700	Titums	2.845098	yourDia-	845
	800		2.903089	gonal Scale.	903
	900		2.954254		954
	1000	11		The whole	Radius
	of y	our Diagon	al Scale = 1	000.	1

The

Legarishms are Series of Artificial Numbers, invented for the Ease and Expedition of Calculat on, proceeding in an Arithmetical Proportion, as the Numbers they answer do in a Geometrical one.

The Divisions of the Tenths between each of the Primes are found thus: Look in the Table of Logarithms for 11 or for 110 (it matters not which, because 1 at the Beginning of the Line and one Tenth is 11) and take out its Logarithm .041393 (omitting the Characteristick and the three last Figures) and there will remain .041, which take from the Diagonal Scale, and set from 1, to one Tenth, on the Line of Numbers: Again look in the Table for 12 or for 120, and against it you will find .079181 take 79 from your Diagonal Scale, and set from 1 to the second Tenth in the sirst Prime: Proceed thus for all the intermediate Divisions in the Line of Numbers: But for your better Information, I shall insert the following Table.

# A Table for dividing the Line of Numbers to any Radius what soever.

		Logar.	_	Logar.		Logar.	11_	Logar.	!	Logar.	1
1	1	00	21	322	41	612	61	785	8.	908	I
	2	30	22	342	42	623	62	792	82		J
	3	47	23	362	43	633	63	799	83	919	١
	4	60	24	380	44	643	64	806	84	924	ı
	5	70	25	398	45	653	65	813	85	929	ı
		78	26	415	46	663	66	819	86	934	ı
	7 8	84	27	431	47	672	67	826	87	939	ı
		90	28	447	48	681	68	832	88	944	ı
	9	95	29	462	49	690	69	839	89	949	ı
	10	100	30	477	50	700	70	845	90	954	ı
	11	041	31	491	51	707	71	851	91	959	ı
	12	079	32	505	52	716	72	859	92		l
	13	114	33	518	53	724	73	863	93	968	İ
	14	146	34	531	54	732	74	869	94	973	ı
	15	176	35	544	55	740	7.5	875	95	978	ı
	:6		36	556	56	748	76	880	96	982	ı
	17	230	37	568	57	756	77	886	97	987	l
	18	255	38		58	763	78	892	98	991	1
	19	279	39	591	59	771	79	898	99	996	1
	20	301	40	602	60	778	80	903	100	1000	ı

This Table is taken from the Table of Logatithms, as has been taught above

2. The Line called the Malt-Depth marked M D, is no-Shewing how thing but the Line of Numbers turned the contrary Way, and is the Malt Line is so ordered that the Number 1 on M D may stand exactly even put on the Rule. or right against M B on the Line A, and then all the the other Divisions will fall in their true Places. By this means, any Number on A or B, multiplied by any Number directly under it on the Line M D, will always be equal to 150.42 the Number of Inches in a Malt Bushel.

3. The

Shewing how the 3. The Line of Segments for the middle Frustum of a Sphe-Line of Segments roid hing, may be put upon the Sliding Rule in the following is put upon the Manner: Take some Vessel hing, as a Butt, and fill it full of Water, then find its Content in Ale or Wine Gallons, (for it matters not which) take also its Bung Diameter in Inches and Decimal Parts. Now to find against what Number, on the Line of Numbers of the Sliding Piece, any Division of the Line of Segments must stand; suppose the Division 1, I say as Unity is to .o1, fo is the Content of the aforesaid Vessel in Gallons to a fourth Number, which will be the Gallons, or Gallons and Parts that are contained in such a Segment of the Vessel; as .01 is of a fimilar Vessel, whose Area is supposed Unity; then let out of the Vessel as many Gallons as that fourth Proportional directs, and having taken the dry Inches, fay, by the Rule of Three Direct, As the Bung Diameter is to those dry Inches found, so is 100 to a fourth Number; which will be the Number on the Line of Numbers mark'd N, against which the Division 1, on the Segment Line must stand. Again, to find where the Division 2 must stand on the Line of Segments, say, As 1 is to .02, so is the Content of the aforesaid Vessel to the Gallons that must be taken out of it; then fay, As the Bung-diameter is to the dry Inches, so is the 100 on the Line N, against which the Division 2 must stand. Proceed in this manner for finding the Divisions 3, 4, 5, 6, 7, 8, 9, and when you come to find where the Division 10 must stand, you must fay, As Unity is to the Vessel's Content, so is I to the Number of Gallons to be taken out of the Veffel; and go on as before.

Moreover, to find where the Division 20 must stand, say, as 1, is to the Content, so is 2 to the Number of Gallons to be ta-ken out of the Vessel, &c. In this Manner may the Divisions to 100 be found.

To find where the first Subdivision before I must stand : fay, As I is to the Veffel's Content, fo is .002 to the Number of Gallons to be let out of the Veffel, and proceed as at first directed. And for the fecond Subdivision, make .003 the third Term of the Rule of Three, and proceed as before. For the Subdivisions between 1 and 2, 2 and 3, &c. Suppose 1 to be .0100, then the first Division from 1 will be .011, the second .012, the third .013, &c. which must be made the third Term of the first Rule of Three for finding where any of those Subdivisions must stand. And for the Subdivisions between 10 and 20, 20 and 30, you must suppose 10 to be .10, and 20 to be .20; then the first Subdivision from 10 will be .11, the second .12, the third . 13, &c. which will be the third Terms in the Rule of Three for finding where these Divisions must stand.

For the Line of Segments for standing Casks.

LASTLY. The other Segment Line on the same Face of the Rule, may be made in the fame Manner as this, by fetting the aforesaid Vessel upright, and making Use of the Length instead of the Bung Diameter.

4. The

4. The Conftruction of the Lines on the other Edge of the The Lines for the Rule for the four Varieties of Casks, are thus, 1. For the 4 Varieties of Spheroid; if there be a Cask in the middle Frustum of a Spheroid, half the Difference of the Squares of the Bung and Head Diameter, added to the Sum and half Sum of the faid Squares, divided by 3, will be the Square of the mean Diameter for a Spherodial Cask, the Square Root of which will be the mean Diameter. 2. Three Tenths of the Differences of the Squares of the Bung and Head Diameters, added to the Sum and half Sum of the faid Squares, and the whole divided by 3, will be the Square of the mean Diameter of a Cask of the second Variety. 3. To the Sum and half Sum of the Squares of the Bung and Head Diameters, add one Tenth of the Difference of the faid Squares. which Sum divided by 3, gives the Square of the mean Diameter of a Cask of the third Variety. 4. And lastly, From the Sum and half Sum of the Square of the Bung and Head Diameters, Subtract balf the Square of the Difference of the Diameters, and the Remainder divided by 3, will be the Square of the mean Diameter of a Cafe of the fourth Variety, commonly called the Frustum of a Cone.

12. The Inside of the two Sliders are divided into Inches, How the Inside and every Inch into 10 equal Parts; the other Line which ly- of the two Sliders eth by the Side of the Line of Inches is the Area in Ale Gallons and Decimal Parts of a Gallon; which by the Rule are

made thus, viz.

Set Unity on C.

To A & the Ale Gauge Point upon D.

And against any Diameter on D,

Is the Area in She Gallons, and Decimal Parts of a Gallon

So as the Rule new stands, it is a Table for all Diameters what-

foever

Note: The Gallons are put in large Figures, and the Tenths of a Gallon in smaller Figures; every Tenth of a Gallon is divided into sove by a small Division, every one of which signifies two hundred Parts of a Gallon. By which I see as the Rule now stands, that a Tub of 19 Inches Diameter will hold a little more than one Gallon upon an Inch deep; and 24 Inches diameter gives for the Area 1 Gallon and 6 Tenths; 30 Inches diameter gives 2 Gallons and a half, and 36 Inches diameter gives 3 Gallons and 6 Tenths of a Gallon for the Area, or what such a Vessel holds upon one Inch deep.

13. Construction of the four Foot Gauging Rod.

1. This Rod \* whose use is to find the Quantity of Liquors con- Of the four Foot Part I.

D tained Gauging Rod.

\* There is a four Foot Gauging Rod contrived by Mr Branan, some time a Collector of the Excise, which also serves for a Sliding Rule; the middle foint is made with a Socket to take in and out; so that when each two Foot is shut (they are made with the common Gauging Lines on them) they slide one by the Side of the other; and it answers every Parpose of our Sliding Rule above described.

How to find

tained in any Kinds of Vessels, is usually made of Box-wood, and confifts of four Rules, each a Foot long, and about 1 an Inch fquare, join'd together by three Brass Joints; by which means the Rod is rendered four Foot long, when the four Rules are quite opened, and but one Foot when they are folded together.

Of the Line of Ale Areas.

2. On the first Face of this Rod a Line of Inches is placed, (and sometimes with it a Line of Ale Areas, ) decimally divided; whose use is to take Gauges of Ale, Wine, Malt, &c.

Of the Diagonal See Plate 4,

3. Two diagonal Lines are placed near the Line of Inches, one for Ale, and the other for Wine, to find the Content of any Spheroidal Cask, by putting the Rod in at the Bung of the Vessel till the Intersection \* of the Head of the Vessel meet with the Staves opposite to the Bung-Hole, so that BF is the Diagonal Line.

How the Diagonal Line is made for Ale.

Fig. 3.

4. By the Bung, Head, and Length of a Cask we find its Content, in Ale and Wine Gallons, and also the Cask's Diagonal Line, as has been shewn in Page 25. For

As the Content of any Cask in Ale or Wine Gallons,

Is to the Cube of its Diagonal; So is the Content of any other Cask, To the Cube of its Diagonal.

An Example of

Example I. for A L E.

Let it be required to find by the four Foot Gauging Rod, the Length of the Diagonal Line of a Spheroidal Cask, whose Consent is 10 Ale Gallons?

Say, as 48.3 the Content in Ale Gallons, is to the Cube of its Diagonal 21647.657403, so is 10 Gallons, to 4481.91664 whose Cube-Root is 16,44 the Anfwer.

See Plate 1. Fig. fame, only it is but 3 Feet long.

So that at 16.44 Inches upon the Four Foot gauging Rule, you Place 10 Ale Gallons: But this is performed more expeditiously by the Sliding Rule, thus:

Set 27.8 on D, to 48.3 on E, and as the Rule now stands it is a Table; fo that against any Number of Gallons on the Line E; you have on the Line D, the Length of the Diagonal in Inches and decimal Parts : Thus,

If the Contents in Ale Gallons be 10 20 ne will be 16.44 20.8 23.8 26.25

Example II. for WINE. The Diagonal Line will be

An Example of

Let the Dimensions of a Spheroidal Cask be as above, the Content in Wine Gallons will be 58.97; then for the Diagonal, fet 27.8 on D, to the Content 58.97 on E, and as the Rule now flands you have the Wine Diagonal for a Spheroidal Cafk. Thus,

If the Content in Wine Gallons be 10 15.32 19.32 22.1 The Diagonal Line will be "And fo the Rule will shew you the Diagonal answering for any other Quantity.

Lines for Lon-5. Lines adapted to the London Casks, \*are placed on the other Jon Casks, Ale 5. Lines adapted to the London Cajes, are placed for a Butt and Beer Measure, Faces of this Four-Foot Gauging Rod, viz. 1. A Line for a Butt when not full.

\* Note, These Dimensions of the London Casks are established by Act of Parliament : The Coopers date not make the Cask otherways, on a Penalty of 3 s. 4 d. for every Offence, Stat. standing. 2. For a Butt lying; each of which contains 108 Gallons, Beer Measure. 3. ALine for the Hog shead containing 54 Gallons. 4. A Line for the Barrel of 36 Gallons. 5. A Line for a Kilderkin of 18 Gallons. 6. A Line for a Firkin of 9 Gallons: Then to Gauge any of these Casks in London, there is no more to do than to put in your Rod perpendicular at the Bung, &c. and if the Cask is not full it gives you the Ullage + without any further Trouble.

6. For the same Purpose there are also Lines put on Four-Foot Gauging-Rods for Wine Measure: as first a Ton of 252 Gallons. 2. A Butt of 126 Gallons. 3. A Puncheon of 84 Gallons. 4. A Hog shead of 63 Gallons. 5. A Tierce of 42 Gallons. 6. A Barrel of 31 ½ Gallons. 7. A Rundlet of 18 Gallons. And lastly, an Anchor of 9 Gallons: By these Lines all Brandies and Oyls

are gauged.

7. These Lines for London Casks are made, by setting the How those Lines Veffel level and pouring in one Gallon of Water, and then put are made. the Rod downright into the Bung-hole, (if it is a hing Cask;) or at the Head, (if a standing Cask;) and where the Surface of the Water cuts the Rod, make a Mark or Division for one Gallon; then pour in another Gallon, and where the Surface of the Water cuts the Rod, make the Division for two Gallons: Again, Pour in another Gallon, and where the Surface of the Water cuts the Rod make the Division for three Gallons: Proceed thus, by pouring in one Gallon fucceffively after another, and make Divisions at every Place on the Face of the Rod, to which the Water arises till the Cask be full; and then you have the Scale for that Cask properly divided: Proceed, in the same Manner for every one of the London Casks above-mentioned, and all the Lines will be finished when figured.

Note. The Divisions for Quarts, marked by Dots on the Rod. are made by pouring in a Quart of Water successively, and that you may never be at a loss to know what Cask is in Hand; the Rod will shew you; for by measuring the Depth of the Bung, &c. if it cut 36, 'tis a Barrel, if 18 Gallons 'tis a Kilderkin, &c.

and by the Line for that Cask you must take its Ullage. The Gauging Rod, Flate 1. Fig. 13. is only 3 Feet, or 36 Inches long; it is declinally divided with two Diagonal Lines, one for Ale, and the other

for Wine, which are made as is shewed in Page 34.

# CHAP. XI.

Of Numeration on the Sliding Rule.

HE Lines of Numbers upon the Sliding Rule are laid down from the Logarithms, as has been shewn on the Rule. in Page 30, and are composed of a fingle or double Radius; and the feveral Lines are marked at the End with A, B, C, D, N, &c. For Distinction Sake ; each Radius is divided into nine equal Parts in a geometrical

See Plate A. How to number

Dz The Ullage of a Cask is what it wants of being full.

#### Dumeration on the Kule. Part I.

Proportion, and figured 1, 2, 3, 4, 5, 6, 7, 8, 9, called Primes, whose Signification are arbitrary.

See Plate A

These Divisions are again divided (when the first Divisions are large) into five equal Parts, called Centesms. \* Now the first Figure at the Beginning of the Rule to the Left-band may re. present either .1, 1, 10, 100, 1000, and the same Figure in the Middle of the Rule, if a double Radius, may represent 1, 10, 100. 1000. 10000, and at the End to the Right-hand it may reprefent 10: 100. 1000. 10000. 100000 or 1000000, encreafing in a Ten fold Proportion; and the like may be faid of the intermediate Divisions.

Another Way

Again, the Method of Numeration upon the Sliding Rule may conceiving how to be conceived by this fingle Confideration, viz that what Name or Denomination soever the 1 at the Beginning of the Line is of, the 1 in the Middle of the Line will represent ten times as many; and the r at the End of the Line will represent an bundred times as many: So that if what I have now mentioned is but well understood, it will not be difficult to conceive the Meaning of the intermediate Figures and Divisions. For

> If the Fior and the .or and then .002 the smallarger gure 1 be Division . ter Diviconfider'd, .2 fions will 100. will reit may re-1000. Ipresent 100. represent zo: prefent

Upon Sliding Rules of a Foot long, these Divisions are usually

placed from 1 to 3.

From 2 to 5 upon the Rule, the Tenths for greatest Division) are only divided into two geometrical Parts, called Centesms. Then.

.2 ) and the If you con-.or and the .005 Smaller larger fider the 2. .05 Divisions . Divi-Figure 2, 20. 1. .5 200. will re-10. fions reit may re-2000. present (100. Jpresent (50. present

From 5 to 10 upon the Rule, the Primes are divided into Ten Parts only, and the Centesms must be guess'd at. For

.01 and then the If 5 be conlarger Divifidered, it may fions will repre-500. represent fent 5000.

Example I.

n Example on

Let it be required to find any Number on the Line A, as suppose 2.15042, 21.5042, or 2150.42; here observe, that if 1 at the Beginning being accounted as Unity, the 2 will be 2, and the first grand Division will be 1, and the small Division will be 50, so that the 42 must be gueffed at, it being but a very little more than the small Division or Centesms.

Example

Example II. If 21.5042 be required?

This will also be found at the fame Point; for taking the first Figure for 10, the 2 will be 20, and the intermediate Divisions will encrease in a Ten fold Proportion, viz. the Tenths to Unites, and the Centesms to Tenths, &c.

Example III. If 2150.42 be required to be found on the Rule. The first Figure must be taken for 1000, then will the 2 be A 3d Example. 2000, and the first grand Division after the 2 will be 100, the

small Division 50, and the 42 must be gueffed at : So that 2.15042, 21.5042 and 2150.42 all fall at the fame Point, M. B.

Again. If the Number 1.894 or 18.94 or 189.4 or 1894. be required on the Line D, any of these Numbers will answer the

Point A G, for the Reasons above-mentioned. Lastly. If .785 or 7.85 or 78.5 or 785. were required to be found on the Line C, they will all fall at the same Point; it

being the Area of a Circle whose Diameter is Unity.

Here Note. That the Distance between the Figures 7 and 8 being divided into 10 Geometrical Parts, the Third Figure, viz. r is supposed to be in the Middle between two such Divisions, and therefore equal to .og, if the Divisions be Tenths; or .5 if the Divisions be Unites. If the Number had been 784, something less than half the Space must have been took; if 786 something more.

These Things being well considered, it will be easy to find any Number required in Practice, on the Rule; my next Business shall be to shew how to work any Number on the Rule.

#### CHAP. XII.

MULTIPLICATION on the Sliding-Rule.



OG AR ITH MS perform that by Addition and Of Multiplica-Subfraction, which common Numbers do by Mul- tion on the Rule. tiplication and Division; and the Sliding-Rule at once setting, gives a Multitude of Products at one View: Observing this,

RULE. Set Unity, or 1, on either of the Lines A or B, to ply on the Rule either Factor \* on the Line of Numbers, on either A or B: and against the other Factor on the same Line you had Unity, + is the Product on that Line you had the first Factor.

Example, Let the Product of 6 by 7 be fought? Operation.

Set 1, upon B, to 6 upon A, and against 7 upon B is 42 upon A the Answer.

Or fet 1 upon A, to 6 upon B, and against 7 upon A is 42 upon B the Product fought. Therefore it Matters not which Line you take Unity upon, so you have regard to take the Second Factor on the same Line you had Unity, then your Product will D 3

The Multiplicand and Mu piplier are called Factors.

A ad Example.

An Example

always be found upon that Line you had the Second Factor. And for the Learner's better Improvement, I shall insert the following Examples in Decimals, with their respective Products.

Several Ex-	( 7.3)	(20.2)		(147.5)	1
inples for Prac-	5.7	13.5		77-	
	9.4	7.6		71.4	
	4.2	16.9		71.	
	6.8	13.1	of 18th Artist Commission	89.1	
	14.3	15.7		224.5	
If you Multiply	1.5	by < 33.8	the Products will be	50.7	•
	18.6	6.2		115.3	1
	3.3	25.4		83.8	
	8.9	9.3		82.8	
	7.7	12.9	and the second of	99.3	
	27.1	5.5		149.1	Ē
	(2.7)	( 0.8)		18.4	

#### CHAP. XIII.

# Of DIVISION on the Sliding-Rule.

Of Division on



ULTIPLICATION and Division are a Proof of each other; and the Sliding-Rule is an excellent Proof of any thing that is done in practical Mathematicks by Numbers: For if the Product of any Multiplication be Divided by either Factor. the Quotient will be the other Factor, as appears by the following Examples.

The RULE.

Set Unity or 1, on either of the Lines A or B, (it matters not How to multiply by the Rule. which) to the Divifor on the other Lines:

And against the Dividend on the same Line you had the Divifor, you will have the Quotient on the fame Line you had Unity.

An Example.

Example. Let the Quotient of 42 divided by 6 be fought? Operation.

Set 1 upon B, to 6 the Divisor upon A, and against 42 the Dividend upon A, is 7 the Quotient upon B.

Set 1 upon A, to 6 upon B, and against 42 upon B, is 7 upon A, the Answer required. After

After this Manner examine the following Examples, which are the Products of the Multiplications in the foregoing Chapter divided by the Multipliers.

	[147.5]	( 7.3		20.2	Several Fx-
	77.	5.7		13.5	amples for Prac-
	71.4	9.4		7.6	
		4.2		16.9	
	89.1	6.8		13.1	
	224.5	14.3		15.7	
Divide &	50.7	by 1.5	and the Quotients will be	33.8	
	115.3	18.6		6.2	
	83.8	3.3		25.4	
	82.8	8.9		9.3	
	99.3	7.7		12.9	
_ /	149.1	27.1		5.5	
	18.4	2.7		6.8	

### CHAP. XIV.

Of the fingle Rale of Three Direct, on the Sliding-Rule \*.

N Numbers the First and Third Terms must be of Of the Rule of one Name, and here upon the Rule, the first and Sliding Rule. third Numbers or Terms, must always be had upon the fame Line A or B; and the fecond and either A or B, it matters not which: And that you may fully understand to work any Proportion on the Sliding-Rule observe General RULE.

The Rule

As the first Term upon A, Is to the fecond Term upon B, So is the third Term upon A. To the fourth Term upon B.

That is, fet the first Term upon A to the Second upon B, and against the third Term upon A, is the Answer upon B, &c.

\* Note. The Sliding Rule is of most excellent Use to those skill'd in Afronomy, as I have mentioned in my System, Vol. I. Page 300, 301. This will be more clear by an Example.

Admit the Moon move 14 36 in one Day or 24 Hours, how much will the move in 10 Hours, 24 Minutes?

A. B. A. B.

As 24: 14 36: 10 24: 6 19

Note. From 1 to 2, on the Line A, every grand Division is 6 Minutes, and every small Division is 12 Seconds; but from 2 to 5 every small Division is 30 Seconds; and from 5 to 10, every small Division is 6 Minutes; and from 10 to 20 every small Division 12 Minutes; but from 20 to 24, every small Division is 30 Minutes, and thus by minding the Numeration on the Rule, it answers the Logistical Logarithms in any Case, with ten times more Expedition, as I prove in my Astronomical Calculation; for I do that in a Minute which another Person, unskill'd in the Sliding Rule, cannot personn in ten.

# The fingle Rule of Three Part I.

As the first Term upon B, Is to the second Term upon A, So is the third Term upon B, To the sourth Term upon A: Which is the Answer sought.

An Example.

Example. If 8 Yards of Cloth coff 32 s. what will 32 Yards coft at that Rate?

Operation.

A B A B

As 8 is to 32 fo is 20 to 80.

Or,

B A B A

As 8 is to 32 fo is 20 to 80

Here you see the first and third Terms are taken upon the same Line, and the Second and Fourth are found upon the other;

and in both Operations the same is observed; which being well

understood, you may work any Proportion whatsoever.
Here follow some Examples, for Practice.

More Examples

A. B. A. B. 
$$7.87$$
 $12.47$ 
 $13.5$ 
 $15.5$ 
 $15.47$ 
 $15.5$ 
 $15.4$ 
 $15.5$ 
 $15.4$ 
 $15.5$ 
 $15.4$ 
 $15.5$ 
 $15.4$ 
 $15.4$ 
 $15.5$ 

# CHAP. XV.

Of the Rule of Three Inverse on the Sliding-Rule.

Of the Rule of Three Inverse.



ECIPROCAL or inverse Proportion is when the First Term bears the fame Proportion to the Third, as the Second Term does to the Fourth.

1. Of SINGLE Proportion.

As the third Term upon A, is to the first upon B, So is the second Term upon A,

To the fourth upon B. & Contra.

Example. If 12 Men can do a Piece of Work in 18 Days, how long will 6 Men be in doing the same?

An Example.

Operation.

Men Men Days Days
As 6 is to 12 fo is 18 to 36.

More

Ь

bei

More Examples for Practice.

B. A. B. Men Men Days Days 36 Days 18 36 6 12 36 6 18

Several Ex.

Or, If you State the Question as in common Arithmetic, so that the Supposition may lye in the two first Terms, and the De-Question. mand in the Third, the First and Third being of one Name, the fourth Term or Answer will be of the same Name with the second or middle Term; then Multiply the first and second Terms together, and divide the Product by the third Term, (as has been taught in the 12 and 13 Chap, of this Work) the Quotient thence arising will be the fourth Term or Answer, in a Reciprocal or inverse Proportion.

Then the first Example above, when stated, will stand thus.

M. D. M. D. If 12: 18:: 6: 36

Now by the Sliding-Rule, the Product of the first and second Terms is 216, which divided by the third Term 6, as directed in the 13 Chap. The Quotient is 36, the fourth proportional Term in an Inverse Proportion. And after this Manner may you work Questions in plural Proportion, Fellowship, &c. by multiplying and dividing as the Question requireth; which has been shewn above.

2. Of DUPLICATE Proportion.

Definition. This Rule chiefly concerns the Proportion of Lines to Superficies, or of Superficies to Lines, in which are three Num-Proportion bers given to find a Fourth in a Duplicate Proportion.

Example I. Let the Diameter of a Circle be 12 Inches, its Area is 113.1, What will be the Area of another Circle whose Diameter

is 24 Inches?

Operation.

B. A. B. A. B. A. B. A.

As 12: 113.1::24: 226.2 Then as 12: 24:: 226.2: 452.8

Note. If you put 24 in the fecond Term's Place, then the Answer will be had without stirring the Slider B.

Now take the Reverse of the former Question.

The Areas of two Circles with the Diameter of one of them, being given to find the Diameter of the other Circle.

Example II.

A 2d Example Example II Let two Circles be given, the Area of one is 452.3 and its Diameter 24 Inches, the Area of the other Circle is 113.1 Inches; I demand the Diameter of that Circle?

### Operation.

B. A. B. A.

As 452.8: 24::113.2: 6 whose Double is 12 the Diameter sought. But if you take the leffer Circles, the two sirst Terms, i. e. Area and Diameter in the Supposition, to find the Diameter of the greater Circle, then the fourth proportional Term is the double of the Diameter sought.

B. A. B. A.

As 113.2: 12:: 452.8: 48. half of which is 24, the Diameter fought.

3. Of TRIPLICATE Proportion.

Of Triplicate Proportion. Definition. This Rule concerneth the Proportion between Lines and Solids, in which are three Numbers given, to find a fourth in a Triplicate Proportion.

An Example.

Example I. Suppose an Iron Bullet, whose Diameter is 4 Inches, weigh 9.26 Pounds, what will another Bullet weigh whose Diameter is 8 Inches?

### Operation.

B. A. B. A.

More Examples As 4 is to 8 \[ \frac{9.26}{18.52} \]

More Practice.

As 4 is to 8 \[ \frac{9.26}{37.04} \]

The Answer in Pounds.

And this without moving the Rule when once fet.

A Note.

Note. The Solidity of a Bullet + whose Diameter is 4 Inches, is 33.5 Inches, and that multiplied by 4.422979 and divided by 16 (the Ounces in a Pound Averdupoise) Quotes 9.26 Pounds, Also the Weight of a Bullet whose Diameter is 8 Inches will by the same Rule be found to be 74.14 Pounds.

A 2d Example. Example II. If a Gun of 5 Inches Diameter require for her due Charge 16 Pounds of Powder; how much Powder will a Gun of 4 Inches Diameter require, for her due Charge of the

same Powder?

#### Operation.

More Examples. As 5 is to 4 \( \begin{array}{ll} \begin{array}{ll} A & B & B & 16 \\ 12.8 & 10.24 & 10.24 \\ 10.24 & 10.24 \\ \end{array} \] The Answer Pounds, without moving the Rule when once set.

CHAP,

### CHAP. XVI.

To find a Geometrical mean Proportional \* between any Two given Numbers.



O find a Geometrical Mean is of great Use in all Of a Geometrical Sorts of Mensurations, which are to be wrought mean Proportion. T By the Sliding Rule; as you will the better perceive by reading what follows.

### The RULE.

The Rule.

Set one of the given Numbers on D, to the This is always fame Number upon C, and against the other Number upon C, wrought upon the Lines C and D. is the Geometrical Mean upon D.

Example I. I demand the Geometrical Mean between 4 and 6? See Page 24

### Operation.

Set 4 upon D, to 4 upon C, and against 6 upon C, is An Example. 4.89 upon the Line D, the Answer required. Example II. What's the Geometrical Mean between 20 and 30?

### Operation.

Set 30 on D, to 30 on C, and against 20 on C, is 24.49 on D the Answer.

Note. It matters not which of the two Numbers you take first; for if I had set 20 to 20, in this Example, of 6 to 6 in the first Example, the Answers would have been the same as by Trial you may find. Here follow some more Examples for Practice.

A Note

	[16]	S 27.4	)	20.95 Several Examples
	24.5	12.		17.1 for Practice.
Aller a let a source with the	12.8	40.5	Consi	22.8
Take Kood amage mak	29.2	50.1	ke seleció	38.2
What's the Geome-	40.1 5 And	18.6	Anfwer	27.3
trical Mean be-	81.	25.		745.
tween	21.4	36.5	To a Share	28.6
	32.	62.		44.6
	46.6	100.75		68.5
	3.41	12.5		5.9
Dai ta Balika 1			CL	I A D.

A mean or middle Proportional between any two Numbers, is that which hath the fame Proportion to the Third Term that the first bears to it. Thus 8 is a mean Proportional between 2 and 32, because as 2 is to 8, so is 8 to 32.

### CHAP. XVH.

To extract the Square Root upon the Sliding-Rule.

To extract the Square Root.



O perform this, there is no more to do than to set the Lines C and D even; that is to say, set one on C to one on the Line D, and as the Rule now stands, it is a Table for the Extraction of any Square Root whatsoever.

So that if you look for any Square Number on

C, right against it on the Line D is the Root thereof.

Example, If you would have the Square Root of 9, you will find it to be 3.

### More Examples for Practice?

Several Examples for Practice.

(	16)	C 4
If the Square	The Square Root will be	)12
	2401	)49
	6561	(81

# CHAP. XVIII.

The Extraction of the Cube Root by the Sliding Rule.

To extract the Cube Root;



O perform this you have nothing more to do than to fet the Lines D and E even; and then against any Cube Number upon E, is the Root upon D: And as the Rule now stands, it is a Table of Cubes and their Roots of any Number whatsoever.

An Example.

Example. Admit 1728 were a Gube Number, and its Root required?

First, Seek for 1728 upon the Line C; which found make a Dot upon the Rule with the Pen; then move the Slider, (either

But if you have a Sliding Rule (fuch as Verie's, &c.) that has not on it the Cube Line, this Defect may be supplied by the Lines C and D; thus. Find the given Cube Number upon the Line C, then move the Slider C; (any Way) until that Cube Number stand against the same Number on the Line D, that 1, on the said Line D, doth on the Slider C; then doth Unity or 1 on D, cut the Cube Root upon the Slider C. This Hint I had from Mr Charles Eades, Master of the Mathematical School at Letersfield in Hampfire.

# Chap. XVIII. Extraction of the Cube Root. 45

(either way) until the Number 1728, on C cut the same Number on D, that I upon D doth upon C, which are 12 on both Lines; fo I conclude that 12 is the Cube Root of 1728, as was required. And by the same Rule you will find the Roots of thefe.

	74088		19 42	Several Ex- amples for Practice.
If the Cube Num-	729 512 343	the Cube Root	8 7	
ber is	125 64	>will be	5	
	27 8		3 2	

To prove the Truth of the above Method of extracting the The Proof. Cube Root upon the Lines C and D, I have taken no small Pains to examine it; and I find it to be very just (though a little troublesome) as I thus prove.

Set 1 or 10 (according as your Number is for Largeness) on D, to the Root upon C, and against the Cube Number on C, is another Root upon D, that is a Number equal to, or the very same with the Cube Root.

Example. Set 10 upon D, to 9 (the Cube Root of 729) up-

on C, and against 729 upon C, is 9 upon D.

Again. Set 10 upon D, to 8 upon C, and against 512 up-

on C, is 8 upon D, a Number equal to the Root.

Also. Set 10 upon D, to 7 upon C, and against 343 upon C is 7 upon D; and thus you may examine and prove the Extraction of any Cube Root whatfoever.



CHAP.

### CHAP. XIX.

Of Divisors, Multiplicators, and Gauge Points, used in Gauging, and all Sorts of Mensurations what soever.



E must carefully attend to the true Ratio + of the Diameter of a Circle to the Circumierence, which was first found near the Truth by Archimedes, and his Proportion was as 7 to 22, or according to Melius as 113 to 335; that is, if the Diameter of a Circle be 7 (of any Thing

whatsoever) then the Circumference would be 22; but this is not only erroneous, but also troublesom, because it requires both Muliplication and Division: This might possibly invite the famous Van Ceulen \* to fearch more narrowly into the Affair, who after many tedjous Trials found the Circumference of a Circle to be 3, and thirty five Decimal Places more; that is, if the Diameter of a Circle be Unity or 1, then the Cir-

Hodglon's Syf. cumference is 3.14159265358979323846264338327950288:
tem of the Ma-But that great Master of Numbers Mr Abraham Sharp
the maticks, Vol. has doubled that Number of Places; and Mr John Machin the present Professor of Astronomy in Gresham - College, and Secretary to the Royal Society has carried it to 100 Places. But after all these great Numbers, they are no more than an Approximation; however in Practice you never need to take more than 3.14159. For that will be sufficiently exact in any Thing of Bufiness that may occur.

The Rule. 1. Now according to the Demonstration of Archimedes ||, if we multiply half the Circumference of a Circle, by half the Diameter, the Product is the Area or Superficial Content of that

Circle.

Example.

Sharp and Ma

chin's Propor-

1 When two Quantities or Numbers are compared one with another in respect of their Greatness or Smallness, that Comparison is called Ratio, and signifies the Rate, Reason, or Proportion, that one hath to the other.

\* Ludosphus van Ceulen was born Anno 1540, died 1610, and lies buried in the great Church at Leyden, on whose Tombstone are engraven the Numbers above specified, with the Dates of his Birth and Death, as it was taken off and brought me by one of my Pupils, who had been to wist that University, in Officer 1725. And besides those I have mentioned above, Grimberger, Melius, Saillius, and others, have wrote upon this Subject.

A Circle is composed of an infinite Number of Triangles, whose Bases are equal to the Periphery, and their Perpendiculars to the Radius of the Circle. Or according to Archimedes, a Circle is equal to a Triangle which hath for its Base the Circumserence, and for its Height the Semi-diameter of the Circle. Whiston's Euclid. Page 192.

A Note

Example. Let the Diameter be 1, the Circumference is Of a Circumference and Dia-3.141592 meter.

Half the Circumference 1.570796 Half the Diameter

The Area, or Superficial Content

2. If Unity be divided by its Area + the Quotient will be How to find 1.2732406; by which if you multiply the Divisor for a Gauge Points, Square, it will give you the Divisor for a Circle, the Square Root of which will be the Gauge Point on the Sliding Rule.

Note. This Number 1.2732406 is the Square of the Diameter of a Circle, whose Area is Unity. For if the Area of any Circle be multiplied by 1.2732406, the Produst will be the Square of the Diameter, whose square Root is the Diameter

of that Circle.

You are to observe, that 12 Inches long and 12 Inches broad, How this is are 144, the Inches in a square Foot: and that 282 solid found, is shewn in a square Foot: Inches are an Ale Gallon, and 231 a Wine Gallon, and 2150.42 Page. cubic Inches is a Winchester-Bushel; and 1728 are the folid Inches in a Foot of Timber or Stone, it being the Gube of 12.

Area of Unity Unity Quotient Example I. .7853975)1.0000000000000(1.2732406

Now multipty 1.2732406 by the Divisor for a Square, To find the which will give the Divisor for a Circle in the same Mea-Ale-

The Multiplier or Multiplicator for reducing a Square to a Circle is 1.2732406 The Divisor, for a Square, Ale Gallons

> 25464812 1018592.8 25464812

The \* Divisor for a Circle, Ale-The Gauge Point 359.0538492(18.94 for Ale Gallons.

Example II. Of Wine. The Multiplier for reducing Square Wine Gallons to a 1.2732406 Circle is The Divisor for a Square Wine Gallon 231

To find the Gauge Point for! Wine.

12732406 83197218 25464812

The Divisor for a Circle.

294.1185786(17.14 Gauge Point for Wine.

Example

Area of any Figure in Geometry is its intimate Capacity or superficial Content. The Square Root of this Divisor 359.0538492 is the Gange Point for Ale Gallons.

# Dl Bauge Points, &c. Part 1.

To find the Gauge Point for Malt.

Example III. Of Malt.

The Multiplier for reducing the square Malt Bushel to a Circle is

1.2732406

The Divisor for a Square Malt-2150.418

Bushel.

101859248 12732406 50929624 63662010 12732406 25464812

The Divisor for a Cir
The Gauge Boint

cular Malt Bushel. 2737.9995045708(52.32 for Malt.

To find the Gauge Point for Iquare Feet.

The Multiplier or Multiplicator for reducing a square Foot to a Circle is 1.2732406

The Divisor for a Square Foot.

25

50929624 50929624 2733406

The Divisor for a Circle Foot Measure.

The Gauge 183.3466464(13.54 Point.

To find the Gauge Point for folid Feet. Example V. Of folid Feet.

The Multiplier for reducing the square folid Feet to a Circle is
1.2732406
The Divisor for a folid Foot.
1728

101859248 25464812 89126842 12732406

The Divisor for a Circle \_\_\_\_\_\_ Gauge Paint for for folid Feet. 2200.1597568(46.9 2 folid Foot.

These Gauge Points are the Diameters of Circles whose Areas are one Ale Gallon, &c.

See Part IL

Note. If these Divisors for a Square be divided by the Area of Unity .7853975, the Quotient will be equal to these Products, which are the Divisors for Circles.

And because 40.714 are found to be the folid Inches in a Pound of dry Starch (perfectly made,) and consequently is a Divisor for a Square, the Divisor for a Circle and its Gauge Point are found thus.

1.2732406

Common Multiplier Divisor for a Square

1.2732406 40.714

50929624 12732406 89126842 50929624

- Square Root, or Gauge

For a Circle

51.8387177884(7.2

It often happens in Business, that when one of the Numbers, How to find a (given in the Question) is set to the Gauge Point, that the new Gauge Point other given Number will fall off the Rule, which is remedied upon the Sliding by finding a new Gauge Point, thus; set Unity on C, to the Rule. Gauge Point on D, and against the other 1, upon C, is the new Gauge Point upon D.

Example. Let it be required to find a new Gauge Point to An Example.

Set 1 on C to 7.2 upon D, and against 1 on C, is 2.28

the fecond Gauge Point upon D.

These second Gauge Points are the Square Roots of the Di- What the is vifors proper to any Square or Circle multiplied by 10; that cond Gauge is, in a mixt Number, only removing the Dot one Place near-er to the Right-Hand. Thus 144 is a Divisor for a Footfquare: put a Cypher to it; thus 1440 and its square Root is 37.94 the second Gauge Point for a Square. And 183.34 being the Divisor for a Circle, remove the Dot one Place to the Right Hand, and it will be 1833.4; its square Root is 42.8, the second Gauge Point for a Circle in Feet. The same Method is to be observed in all the other Second Gauge Points.

In Page 18 I have told you that any Thing may be done Of Multiplical by Multiplication, as well as by Division: which is to divide tion and Division Unity by your Divisor; and the Quotient is a common Multi-

plicator: thus, for fquare Factors.

144) 1.0000000 (.0069444 Foot.

282) 1.0000000 (.0035461 Ale Gallon.

231) 1.0000000 (.0043289 Wine Gallon.

2150.418) 1.000000000(.000465 Malt Bushels,

30.28) 1.00000000 (.033025 Tallow Pounds,

So according to the above Method, I have calculated the Following Table following Table of Factors, Divisors, and Gauge Points. A Table

A Table of Fastors, i. e. Multipliers, Divifors, and Gauge-Points, both for Squares and Circles, and their new Gauge-Points.

							ALTONOMIC TO STATE OF		
		Factors for Squares	Factors   for Circles	Divisors   for Squares	Divisors for Circles	Squares Circles	The second second second	2 G P Squares	Circles &
	of Unity —		785398	Y	1.27324		1.128		0
	A Superficial Foot	.0069444	.005454	1728	183.34	41. 560	13.54	37.94	42.8
	Ale Gallon		.0027851	282.	359.05	16.79	18.94	53.1	59.92
	§   	.0043289 .0033999	.00339999	231.	294.118	15.19	17.14	48.06	54.22
· ~	2 Gallons	.0001108 .000087	.000087	9024	11498.71	94.99	107.19	300.39	338.96
don-	1	.0000985 .0000773		10152.	12925.93	100.75	113.63	318.62	359-52
nuy.	llons -	.0001046 .0000821		9588.	12207.7	97.9	110.48	309.64	349.39
	1	.0004651	.0003653	2150.4	z738.	46.37	52.32	14.56	16.54
,	Winch. Bush. Allowance 4 in 20 .000372		.000292	2687.5	3421.8	51.84	58.49	16.39	18.49
	Winchest. Bushel Allow. 8 in 20 .0002791 .0002192	.0002791	.0002192	2583.3	4562.4	59.86	67.57	18.93	21.35
	Winchest. Bushel Allow. 10 in 20 .0002905 .0001826	.0002905	.0001826	4300.8	5476.	65.58	73.99	20.73	23.4
14	Winch. Bush 8 in 20 to 4 in 20 .0003485 .000274	.0003485	.000274	2866.	3650.	53.53	60.4	16.92	19.1
	Winch. Bush. 10 in 20 to 4 in 20 .0002905 .0002283	.0002905	.0002283	3439.2	4380.	58.64	61.18	18,54	20.92
	Tallow Pounds Grofs	.033025	.02594	30.28	38.55	5.502	6.209	1.74	1.96
	Tallow Pounds Near		.0251012	31.4	39.98	5.603	6.32		1.999
	A Pound of Hard Soap -	.036845	.028939	27.14	34.56	5.200	5.88	1.65	1.86
	Soap -	.038956	.0305997	25.67	32.68	5.06	5.716	1.6	1.8
	A Pound of White Soft Soap - 0391235 .0307314	.0391235	.0307314	25.56	32.54	5.05	5.704	1.59	1.8
	A Pound of Green or Raw Starch .024561	.024561	.019291	40.714	51.838	6.38	7.2	2.01	2.28

N. B. These Gauge Points in this Table are the Diameters of those Circles, whose Areas are equal to their respective Divisors.

But for square Vessels, the Gauge-Points are the Side of a Square whose Area is equal to their respective Divisors.

Multipliers for

After the same Manner the Factors or Multipliers for Circles how tound. are found by dividing Unity by the circular Divisors, thus:

183.34)1.000000000(.0054541 Foot

359.05)1,000000000(.0027851 Ale Gallon

294.12)1.000000000(.0033999 Wine Gallon

2738. )1.000000000(.000365230 Malt Bushel

38.55 )1.00000000 (.025940 Tallow Pounds.

### Or.

The same Factors for Circles may be found by dividing the How found any Area of Unity by the Divisors for Squares, and the Quotient will ther Way. be the Multiplier for Circles. The above Factors may also be found thus.

144).785398(.005454 Foot

282).785398(.002785 Ale Gallon

231).785398(.003399 Wine Gallon

2150.418).785398(.0003652 Malt Bushel

30.28).785398(.0259 Tallow Pounds.

Having the above Divisors and Multipliers, if the Diameter Of the Diameter of a Circle be squared, and divided by the proper Divisor, the Circle.

Quotient will be the Area of that Circle.

#### Or.

If it be multiplied by its proper Factor, the Product will be Another Way.

Example. Let the Diameter of a Circle be 24 Inches, I de Ma Example mand the Area in square Feet, and also in Ale Gallons?

# Of Gauge Points, &c. Part I.

The Area in Feet by Multipli-

The fame by Division.

See the Work.

By Multiplication.

The Square of 24=576 Multiplier for a Circle.005454

Answer 3.141504 Feet, the same as by Division. Here follows the fame.

The Operation for Feet.

By Division.

183.34)576.0000(3.14 55002. .. 25980 18334

> 76460 73336

3124

The Area in le Gallons by Multiplication.

The Operation for Ale. By Multiplication.

Multiplier for a Circle.0027851 Square of a Diameter 576

> 167106 194957 139255

Answer 1.6042176 AleGallons the same as by Division,

The Operation for Ale.

By Division. 359.05)576.0000(1.60 35905

> 216950 215430

> > 15200

The fame by Division.

Chap. XIX. Of Bauge Points, &c.	53
Note. These Multipliers are the respective Areas of a Circ, whose Diameter is 1.	le Those Multi- pliers what.
By the Sliding Rule on the Line A and B. For Feet.	The fame Ex-
A B A B	the Sliding Rule.
As 183.34 is to 24 so is 24 to 3.14 Divisor Diameter Diameter Feet, the Area	•
Or,	
By the Gauge Point on the Lines C and D.	
D C D C	
As 13.5 is to 1 fo is 24 to 3.14 Gauge Point Unity Diameter Area in Feet.	
For the Area in Ale Gallons.	The fame Ex
A B A B	Gallons by she
As 359.05 is to 24 fo is 24 to 1.6 Divisor Diameter Diameter Area	Sliding Rule.
Or,	
By the Gauge Points on the Lines C and D.	
D C D C	
As 18.94 is to 1 fo is 24 to 1.6 Gauge Point Unity Diameter Area	
Note, If the Square of the Diameter of any Circle be Multiplied Divided. } by \ 1.273241 \ 2uotient \ is the Area.	A Note:
in the fame Parts that your Dimensions are of.	
And for the Benefit of the young Student, I shall here infert, 1. The Dimensions of a Circle. 2. The Side of the Square equal. 3. The Side of the Square inscribed. And 4. The Side of the Equilateral Triangle inscribed, putting for the Diameter	View of all these
Unity or 1. 1. If the Diameter of a Circle be 1.	Diameter of a
Then the Side of the Square equal Side of the Equilateral Triangle Side of the Square inscribed 3.141592  Side of the Square inscribed 3.141592  .886227 .866024 .707106	
C Area — — — — — — — — — — — — — — — — — — —	
2. If the Circumference of a Circle be 1.	of a Circle
(Diameter — — ) (.3183101	
Side of the Square equal .282094	
Then the Side of the Equilateral Triangle is 3.2756646 Side of the Square inscribed 2.225079 Area	,
Area — — J C.079577525	

Nove, By the 2d and 12th Books of Euclid's Elements, it is demonstrated that all Circles are in Proportion one to another, as the Squares of their Diameters.

E 3

Side of Square

3. If the Side of the Square equal be 1.

(Circumference — — )	C 3.544907
Then the Side of the Family teral Triangle Ci	1.128379
Then the Side of the Equilateral Triangle is Side Square inscribed	7978844
(Area — — )	Ci.

Side of the Tri-

4. If the Side of the Equilateral Triangle be 1.

	Circumference — —) (	3.627593973
Then the	Diameter — /	1.1547
	Side Square inicribed —	.81649

Square inferibed.

5. If the Square inscribed be 1.

Area of a Circle.

6. If the Area of a Circle be 1.

```
Then the Side of the Square equal — is Side of Equilateral Triangle Side Square inscribed — 1.128379
```

Here follows the Use of these Six Proportions last mentioned.

For Diameter 1. The Diameter of a Circle being given to

The Rule.

The RULE.

If the Diameter of any Circle be
Multiplied by \ 3.14159 \} the Product \ is the CircumDivided \ by \ 3.1831 \\$ the Quotient \ \ ference.

An Example

Example. Let the Diameter of a Circle be 24 Inches, what is the Circumference in Inches.

By the Sliding Rule.

A.	B.		A.		B.
As I is	10 3.14159	So is	24	to	75.4
Unity	Multiplier	So is 24 Diameter		Circumference	

2. The Diameter of a Circle being given to For the Diameter and Side find the Side of the Square equal.

The RULE.

The Rule,

If the Diameter of any Circle be
Multiplied by \{ .886227 \} the Product \{ is the Side of the Divided \} by \{ 1 128379 \} the Quotient \{ Square equal.}

Example. Admit the Diameter of a Circle be 24 Inches, An Example, what's the Side of the Square equal?

Operation by the Sliding-Rule.

A. B. A. B.
As 1 is to .886 fo is 24 to 21.3
Unity Multiplier Diameter Side Square equal

3. The Diameter of a Circle being given to For the Diameter and Side of a find the Side of an Equilateral Triangle inscribed. Triangle.

The RULE.

The Rule.

Multiplied by \$ 1.1547 Sthe Quotient Equilateral - Triangle inscribed.

Example. Admit the Diameter of a Circle be 24 Inches, An Example.]

Operation by the Sliding-Rule.

A. B. A. B.
As 1 is to .866 fo is 24 to 20.8
Unity Multiplier Diameter Side Equil. Triangle,

4. The Diameter of a Circle being given to For the Diameter and Side of a Square inscribed.

The RULE.

The Rule,

If the Diameter of any Circle be
Multiplied by 5.7071067 the Product is the Side of the
Divided 5 by 1.4142135 the Quotient 5 Square inscribed.

Example. Admit the Diameter of a Circle be 24 Inches, what's An Example the Side of the Square inscribed.

Operation by the Sliding-Rule.

For the Diameter and Area.

\*5. The Diameter of a Circle being given to find the Area of that Circle in the same Measure that your Diameter is.

The Rule.

The RULE.

If the Square of the Diameter of any Circle be Multiplied by \ 1.273241 Sthe Product \ is the Area.

An Example.

Example. Admit the Diameter of a Circle be 24 Inches, what's the Area +?

By Multiplication.

Operation by the Sliding-Rule per the Factor, or Multiplier

As 1 is to 24 fo is 24 to 576 Then,

As 1 is to 576 fo is .785 to 452.4 Inches the Answer \*. Or on the Sliding-Rule by Division.

By Division.

As 1 is to 1.273 fo is 576 to 452.4 as before. Unity Divifor Sqr. Diam. Area

The Circum ference and Diameter.

6. The Circumference of a Circle being given to find the Diameter.

The RULE.

The Rule.

If the Circumference of any Circle be Multiplied by \ 31831 the Product \ is the Diameter.

Example. Admit the Circumference of a Circle be 75.4, what's An Example. the Diameter.

By Multiplica-

Operation by the Sliding-Rule, by Multiplication.

.318 is to 75.4 Multiplier Unity Circumference Diameter

By Division,

On the Sliding-Rule by Division. B.

As I is to 3.14 fo is 75.4 to 24 Unity Divisor. Circum. Diameter.

7. The

Of this I have hinted in Page 51, but it is here more largely explained.

N. B. The Area of the Circle above is 452.4 Square Inches, which will give the Area of the Circle in Feet Superficial Ale-Gallons Wine-Gallons Divided by Malt-Bufhels

Pounds of Tallow Grofs

W. B. You will have the same Areas as before if the Square of the Diameter 576 be

183.34,
359.05
294.118
2738
the Divisors for Circles
Ale-Gallons
Wine-Gallons
Wine-Gallons
Malt-Buffels
38.55
Pounds of Tallow Groft

7. The Circumference of a Circle being given In the Circumter for the Side of the Square equal to that Circle. Square Equal.

The RULE.

The Rule.

If the Circumference of any Circle be
Multiplied by \{ .282094 \} the Product \{ \} is the Side of the
Divided \} by \{ 3.544907 \} the Quotient \{ \} Square equal.

Example. Admit the Circumference of a Circle be 75.4, An Example, what's the Side of the Square equal?

Operation by the Sliding-Rule, by Multiplication.

By Multiplica-

A. B. A. B. As 1 is to .282 fo is 75.4 to 21.27

Unity Factor. Circumf. Side Squ. equal, The Anfaver.

Or,

On the Sliding Rule by Division.

By Division

A B B A

As 1 is to 3.54 fo is 75.4 to 21.27

Unity Divisor Circumf. Side Square equal

8. The Circumference of a Circle being given frence and Side to find the Side of the Equilateral Triangle in of a Triangle inferibed.

The RULE.

The Rule

If the Circumference of any Circle be

Multiplied by \{ .2756646 \} the Product \( \) is the Side of the

Divided \} by \{ 3.6275939 \} the Quotient \{ Equilateral - Triangle inscribed.}

Example. Admit the Circumference of a Circle be 75.4, what's An Example the Side of the Equilateral Triangle inscribed?

Operation by the Sliding-Rule, per Factor, or Multiplier.

By Multiplicati-

A. B. A. B.
As I is to 2756 fo is 75.4 to 20.78
Unity Factor Circumf. Side Triangle

Or,

On the Sliding-Rule by Division.

By Division

A. B. A. B.
As 1 is to 3.627 fo is 75.4 to 20.78
Unity Divifor Circumf. Side Triangle.

For the Circumference of a Circle being given ference and Side 5 find the Side of the Square inscribed in that Circle.

The Rule.

The RULE.

If the Circumference of any Circle be

An Example. Example. Admit the Circumference of a Circle be 75.4 what's the Side of the Square inscribed?

By Multiplica- Operation on the Sliding-Rule, per Factor, or Multiplier.

As 1 is to .225 so is 75.4 to 16.97
Unity Factor Circums. Side of the Square.

Or,

By Division.

On the Sliding Rule by Division.

A. B. A. B.
As 1 is to 4.44 fo is 75.4 to 16.97
Unity Divisor Circums. Side of the Square.

For the Circumference of a Circle being given to find the Area of that Circle.

The Rule

The RULE.

If the Square of the Circumference of any Circle be
Multiplied by \{ .079577525 \} the Product \{ is the Area.}

An Example.

Example. Admit the Circumference of a Circle be 75.4, what's

the Area?

Now before we can give a Solution to this Question, we must find the Circumference of those Circles whose Areas are equal in Quantity to the Inches, Feet, Gallons, Bushels, Pounds, &c. which will be Gauge-points upon the Sliding-Rule.

A further Rule.

The RULE.

Multiplied by \$12.566368 \text{ the Product } is the Square of Divided by \$12.566368 \text{ the Product } is the Square of Divided the Circumference, whose Square-Root is the Circumference fought.

An Example. 1. Example. For Feet.

The Common Multiplier 12.566368
The Square Inches in a Foot 144

The Operation

50265472 50265472

Square of the Circum. 1809.556992(42.538 Point for Feet.

82)209 164 845)4555 4225 8503)33069 25509

> 85068)756092 680544

75548

After the above Manner I calculated the Circumferences, or Gauge points in the following Table, which will be of excellent Use to find the Area or Solidity of any of these under mentioned; especially in Timber-Measure, when only the Circumference is given.

A TABLE of the Circumference of Circles answering the Areas in A Table of Areas the fecond Column, which are Gauge-points upon the Sliding and Gauge Points Rule, on the Line D.

		Areas.	G. Points
ample of its Ule in Page 78.	A Superficial Foot  A Solid Foot  Alle Gallon  Wine Gallon  Malt Bushel  Tallow Pound Gross  Ditto Net  A Pound of bard Soap  A Pound of Green fost Soap  A Pound of Green or Raw Starch	144 1728 282 231 2150.4 30.28 31.4 27.14 25.67 25.56 40.714	42.538 147.36 59.529 53.878 164.38 19.5066 19.8641 18.4675 17.9605 17.9219 22.610

Now for the Area in Feet, when the Gircumference is 75.4. by An Example the Sliding-Rule. of Feet.

D. C. D. C. As 42.54 is to 1 fo is 75.4 to 3.14 G. P. Unity Circumf. Fees. An Example

## Of Gauge Points, &c.

Part I.

For Ale.

D. C. D. C.
As 59.53 is to 1 fo is 75.4 to 1.6 Gallons.
G. P. Unity Circumf.

For Wine.

Of Wine.

D. C. D. C.
As 53.88 is to 1 so is 75.4 to 1.95 Gallons.
G. P. Unity Circumf.

Of Malt.

For Malt-Bufbels.

D. C. D. C.
As 164.38 is to 1 so is 75.4 to .21 Decim. Parts of a Bushel.
G. P. Unity Circums.

Of Tallow.

For a Pound of Tallow Gross.

D. C. D. C.
As 19.51 is to 1 fo is 75, to 1.48 Pound.
G. P. Unity Circumf.

A Note.

Note. This Divisor 12.56.636217 is not to be found in any of the fix Properties of a Circle in Page 50; but the Factor is in the Second thereof, therefore (as I have before taught) divide Unity by the said Factor .079577525, and the Quotient will be the Divisor 12.56636317.

Or,

It is grounded upon this universal Theorem, that when the Diameter is 4, the Circumference and Area are equal, viz.

12.566368.

By the Ten Operations on Pages 54, 55, 56, 57, I have shewn how to find any of the Parts in the Circle (Plate 1, Fig. 1,) when the Diameter and Circumference are given, and to go through all the Parts thereof will require Towenty Operations more, which I shall leave unperformed to try the Learner's Ability; only he is to observe,

Some Proper-

- 1. That when the Diameter of one Circle is 1, and the Diameter of another Circle is 2, the Circumference of the first is equal to the Area of the second, viz. 3.141592.
- 2. If the Circumference be 4,
  The Diameter sviz. 1.273241
  and Area are equal
- 3. If the Diameter of a Circle be 4,
  The Circumference and Area are equal \ \ viz. 12.566368

Hence, because Circles are the most capacious of all other Figures, it will not be unacceptable to the diligent Reader to let him see that if he takes the fourth Part of a Circle, and square it, that will not be equal to the Area of that Circle; altho' the four

four Sides taken together are equal to the Circumference of that Circle.

So in the Circle above made use of, whose Circumference is Plate 4. 75.4 its Area is 452.4: the fourth Part of the Circumference is Fig. 1. 18.85 which squared is only 355.3225 which is no less than 97.0775 less than the Truth, in that Circle whose Diameter is 24; so that the greater the Circle is the greater will the Error be.

For further *Proof* of this Matter, and to make it plain to the meanest Capacity, if you take a *Pewter Pint Ale* Measure, whose *Content* is 35.25 *Cubick Inches*, and beat it perfectly into a *Square Form* as ACBD, you will then find it to contain but only 28.902. *Cubick Inches*, that is *less than the Truth* by 6.34840542570781791 The *Area* of the Circle is 8.7615859288, the *Area* of the *Square* is 6.8813320653076624.

Archimedes has demonstrated that if the Diameter of one Circle be double to the Diameter of another, the one Circle will be Four-fold to the other. Whiston's Euclid. Page 217.

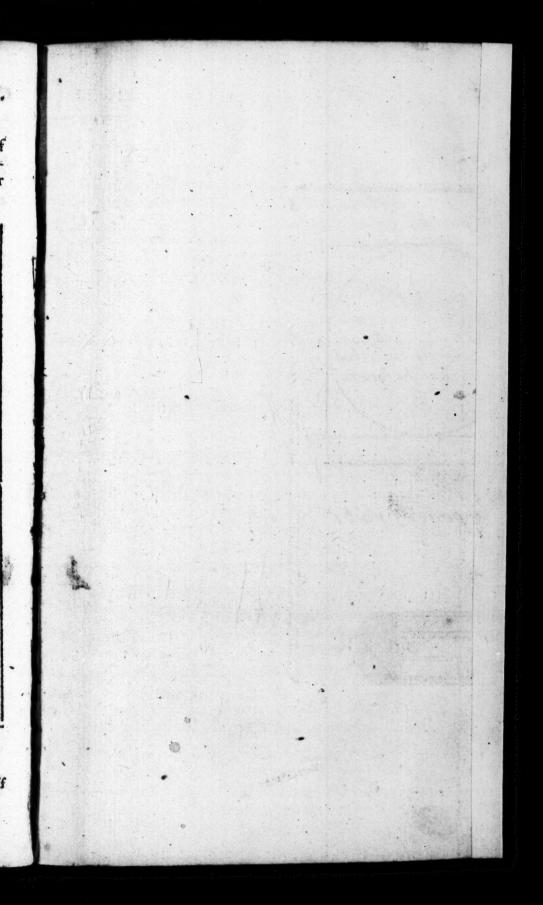
This shews the Reason why taking the fourth Part of the Why Key is Girt in Timber-Measure is false; so that it is evident that Mr wrong and Hop-Hoppus in the Presace to his new Tables of Practical Measuring, pus Right. See (Price 2 s.) has very justly exposed Isaac Key and his Followers. Measurer Page

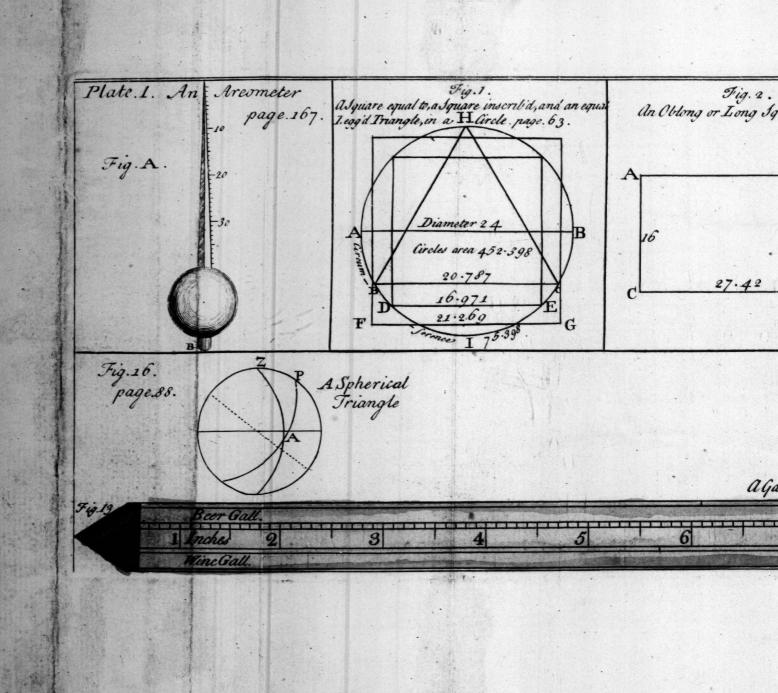
See Plate 4. Fig. 1. for the Demonstration.

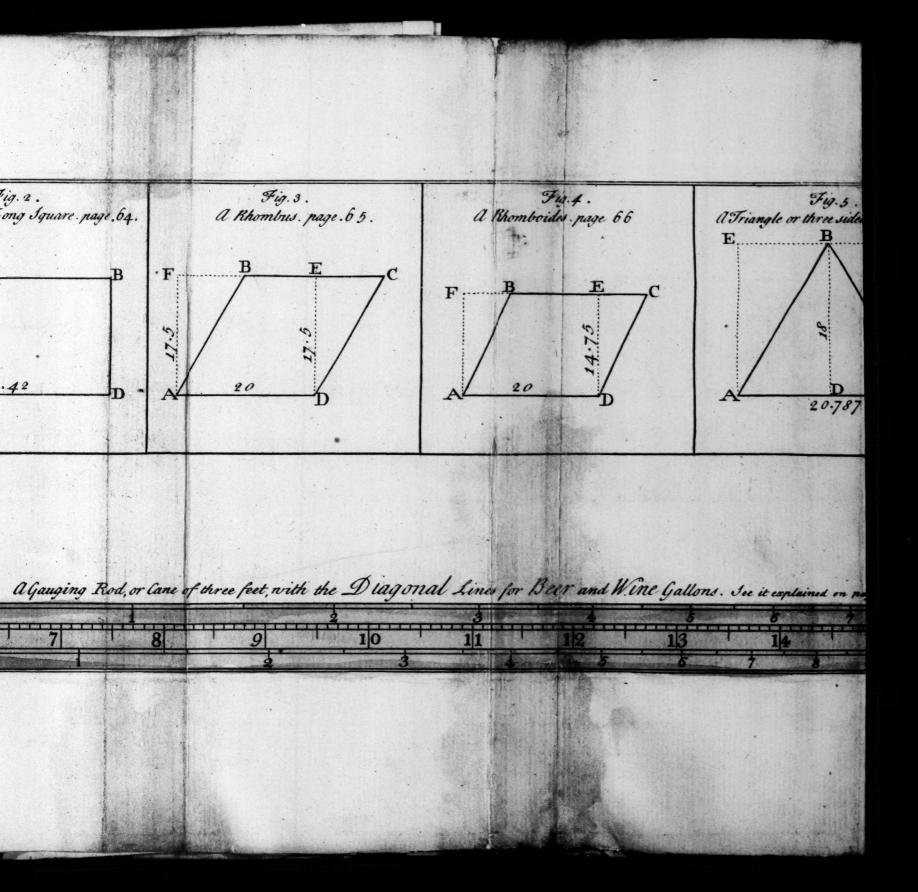


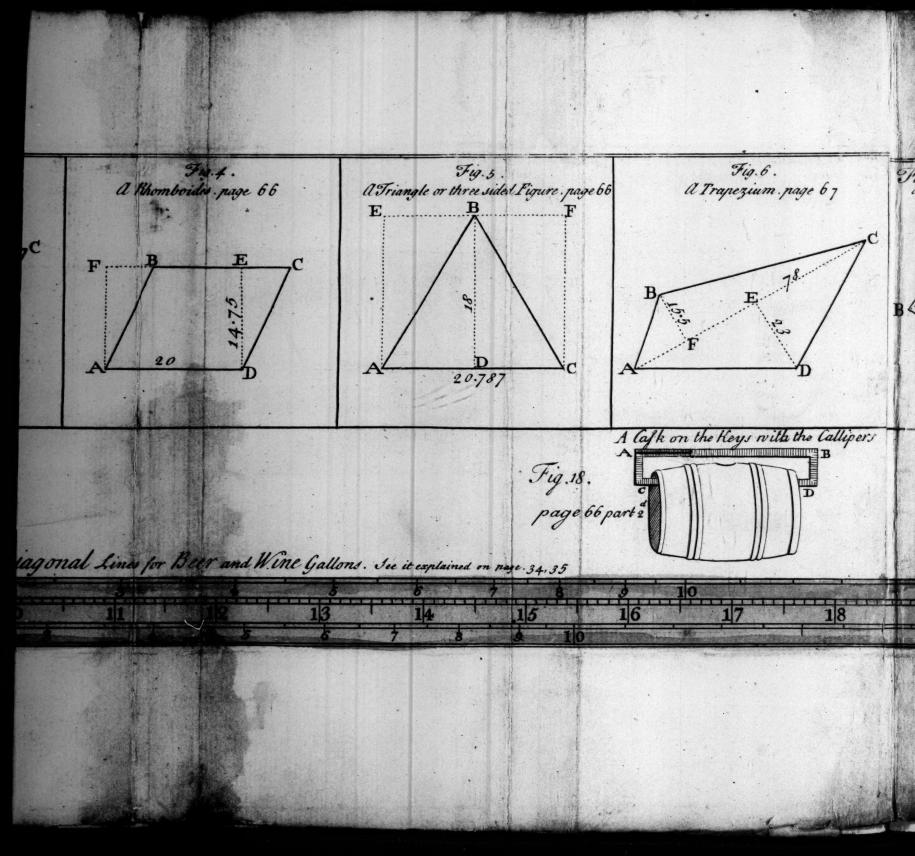
A TABLE of a Superficial Foot, of a Solid Foot, of the Ale and Wine Gallon, of the Malt Bushel, to-gether with the Divisors and Gauge Points both for Squares and Circles.

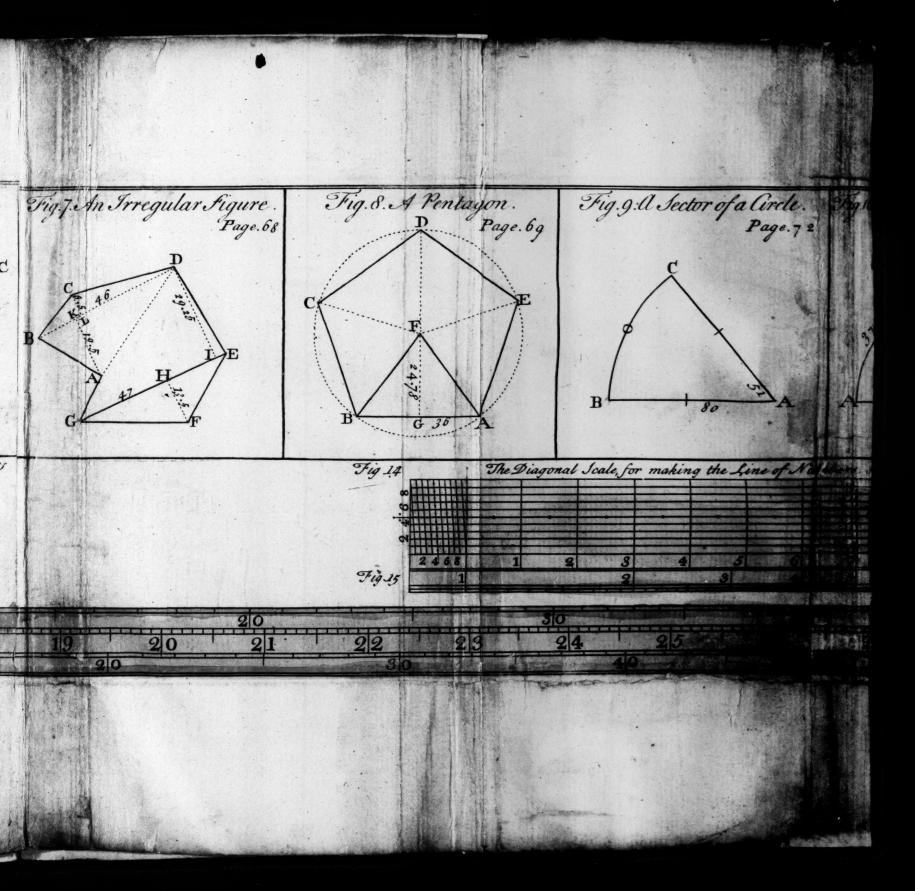
Fora SQUARE.	Superficial	Foot.	Solid Foot.	
	Divisors.	Gauge Point.	Divisors.	Gauge Point.
A Foot — — One Half — One Fourth — —	- 144 72 - 36	8.48 6.	1728 864 432	41.57 29.4 20.7
For a CIRCLE.	Divisors.	Gauge Point.	Divisors.	Gauge Point.
A Foot — — — One Half — One Fourth —	91.67 40.885	13.54 9.57 6.39	2200.158 1100.079 550.0395	46.9 33.17 2345
For a Square.	Ale Divisors.	Gauge Point.	Wine Divifors.	Gauge Point.
A Gallon A Pottle A Quart A Pint Half a Pint	282 141 70.5 35.25 17.625	16.79 11.87 8.39 5.93 4.19	23T 115.5 57.75 28.875 14.4375	15.19 10.72 7.59 5.37 3.79
For a CIRCLE.	Divisors.	Gauge Point.	Divisors.	Gauge Point.
A Gallon  A Pottle  A Quart  A Pint  Half a Pint	359.05 179.53 89.76 44.88 22.44	18.95 13.39 9.47 6.69 4.73	294.1186 147.0593 73.5296 36.7643 18.3824	17.14 12.12 8.57 6.06 4.28
Corn and Malt Measur	Divisors for A Square.	Gauge Point.	Divisors for A Circle.	Gauge Point.
A Bushel — — — Half a Bushel — — A Peck — — Half a Peck — — — — — — — — — — — — — — — — — — —	2150.4184 1075.2092 537.6046 268.8023	46.37 32.79 23.18 16.39	2737.99 1368.995 684.49 342.245	5 2. 32 3 6. 99 2 6. 1 6 1 8. 49
of a Peck	134.40115	11.59	171.1245 85.56	9.25

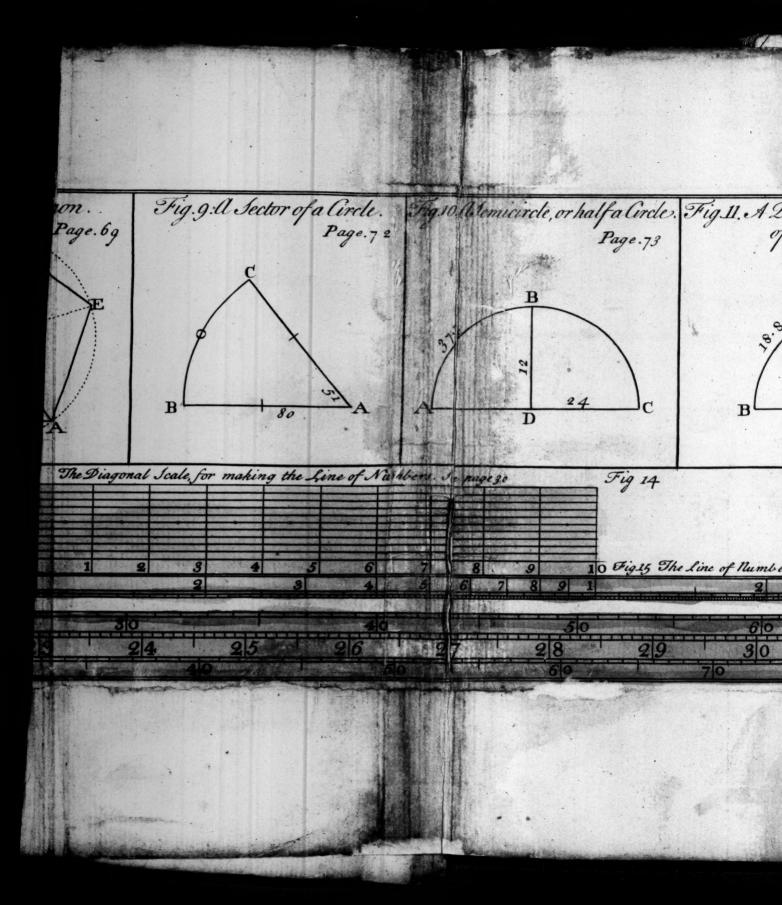


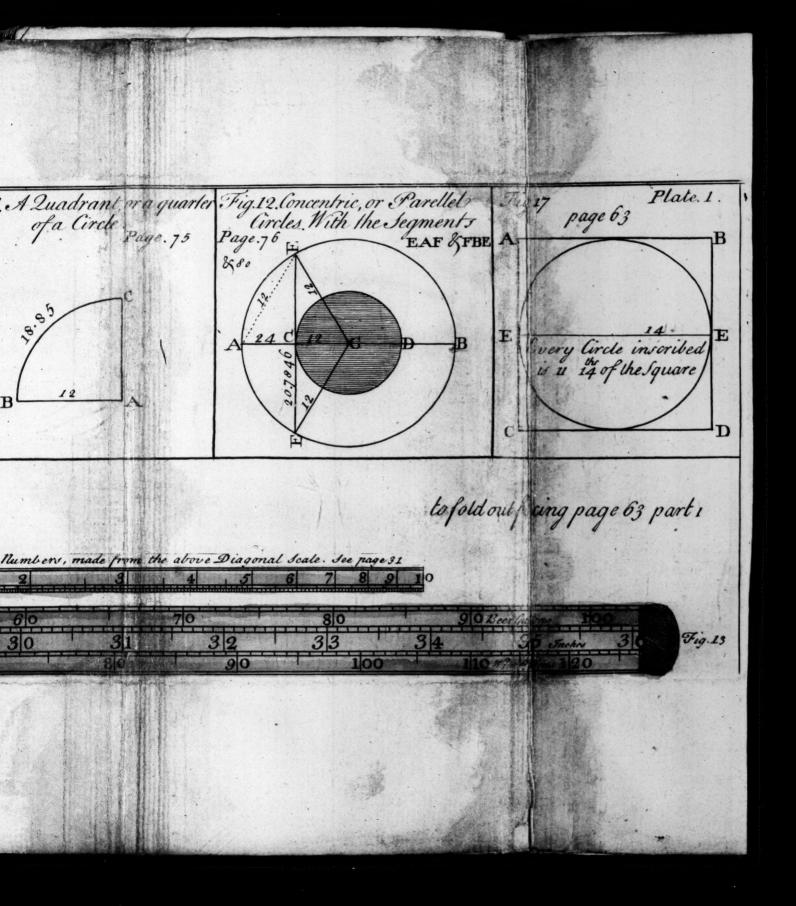












If the Proportion which the Diameter of a Circle hath to its Circumference, be allowed to be as 7 to 22, then the Square made of the Diameter of any Circle, is in Proportion to that Circle; as 14 to 11; and therefore every Circle inscribed within a Square is  $\frac{11}{14}$  thereof.

Plate 1. Fig. 16.

#### Demonstration.

Let the Circle inscribed within the Square be A, B, C, D, See Plate 1.

I say the Area of that Circle is equal to 11/14 of that Square. Fig. 16.

Suppose the Diameter E F be 14, equal to the Side of the Square A B, &c. and the Circumference 44, how will this answer the Theorem?

Operations.

First, As 7 is to 22 so is 14 to 44 the Circums. Side A B = 14

Half = 22

Half the Diameter 7

Area of the Circle 154

Area of the Square 196

Secondly. Say, as 154 is to 196, so is 11 to 14; consequently the Proportion that a Circle hath to a Square whose Diameter and Sides are equal, is as 11 to 14. For you see, as the Area of the Circle is to the Area of the Square, so is 11 to 14.

### CHAP. XX.

Shewing bow to gauge all Manner of Super-

#### See Plate 1.

ND first of a SQUARE.

1. Definition. A Geometric Square is a Figure confisting of four equal Sides, and as many right Angles.

#### The RULE.

Take the Side of the Square in Inches and Decimal Parts by help of your four Foot Rule, and multiply it by itself; divide the Product, by 144 for Feet, by 282 for Of the Square. Plate 1. Fig. 2

The Rule.

As Unity or 1, is the Beginning of Numbers, so a Point is the Beginning of Magmitude, and if a Point be put in Motion, or supposed to move, it will generate, or form a Line, and if a Line be put in Motion, or supposed to move, it will form a Surface or Superficies.

An ANGLE is made by the Meeting of two Lines; and if one Line cut the other by a Perpendicular; that is to say, Square wise, then 'tis called a Right Angle; but if it lean eight may, it makes two Angles, one acute or sharp, and the other obtase or blunt. And in the Business of Gauging, all Superficies or Areas are always understood to be one Inch Angle; otherwise it could not be said (as in the Gauger's Language it is) that the Area of such a Circle, as of such a Back, &cc. is so many Gallons.

Ale Gallons, by 231 for Wine Gallons, and by 2150.4 for Malt Bushels, &c. as in the Table, Page 50.

An Example. Let F G be 21.269 Inches, I demand the Area, or superficial Content in Feet, Ale Gallons, Wine Gallons, Male

Bushels, and Tallow Pounds?

The Operation.

Operation.

F G = 21.269F G = 21.269 191421 127614 42538 21269 42538

Other Examples.

144)452.370361(3.14 Feet

282)452.37 (1.6 Ale Gallons.

231)452.37 (1.95 Wine Gallons.

2150.4)452.370(.21 Malt Bushels.

30.28)452.370(14.9 Tallow Pounds gross.

By the Sliding

By the Sliding Rule for Ale.

A. B. A. B.
As 282 is to 21.3 fo is 21.3 to 1.6, Ale Gall.
Divisor Side Square Side Square

As the Gauge Point 282 upon A is to 21.3 the Side of the Square upon B, fo is 21.3 the Side of the Square upon A, to 1.6 Ale Gallons upon B. And thus you must work for any of the other Questions, by making use of their Gauge Points.

Of the Parallelogram. Plate 1. Fig 2.

The Rule.

2. To gauge a Parallelogram or long Square.

See Plate 1, Fig. 2.

Definition. A Parallelogram is a four fided Figure, having its opposite Sides equal and parallels and the Angles right.

The RULE.

Multiply the Length by the Breadth, and divide the Product by 144, for Feet, by 282 for Ale Gallons, by 231 for Wine Gallons, by 215.4 for Malt Bushels, and by 31.4 for Pounds An Example. Tallow neat.

Example, In the Figure before us, let the Side C D be 27.42 Inches, and A C 16, I demand the Area in Feet, Ale Gallons, Wine Gallons, Malt Bushels, and in Tallow Pounds neat?

Operation.

Operation.

The Operation.

 $\begin{array}{c}
C D = 27.42 \\
A C = 16. \\
\hline
16452 \\
2742 \\
\hline
144)438.72(3.04 Feet
\end{array}$ 

a,

elt

11.

be

to

ny

ng

for

be

Ale

t?

Other Examples

282)438.72(1.55 Ale Gallons

231)438.72(1.89 Wine Gallons

2150.4)438.72(.204 Malt Bufnels

31.4)438.720(13.97 Tallow Pounds neat.

By the Sliding Rule for Feet.

A B A B

As 144 is to 27.42 fo is 16 to 3.04 Feet.

Divisor Length Breadth

By the Sliding Rule for Wine Gallons.

As 231 is to 27.42 so is 16 to 1.89.

Gauge Pt. Length Breadth Wine Gallons

That is, set 231, the Gauge Point for Wine in Square Measure, upon A, to 27.42 upon B, and against 16 the Breadth upon A, is 1.89 Wine Gallons upon B the Area sought †.

3. To gauge a RHOMBUS. See Plate 1, Fig. 3. Of the Rhombus,

By the Sliding

Definition. A Rhombus has four equal Sides, and four Angles, two opposite are obtuse, and the other two opposite are acute; 'tis plain from the Figure that the oblong A, D, E, F, is equal to the Rhombus A, B, C, D.

Definition.

The RULE.

Multiply AD = FE into AF = DE, and divide the Product by 144, for Feet, Sc. as below; and the several Quotients are the respective Area's in those Quantities unto which the Divisors do belong.

The Rule.

Example. Admit the Side of the Rhombus AD be = 20, and the Perpendicular DE = 17.5 Inches, I demand the Area in Feet, Ale, Wine, Malt Bushels, and Hard Soap, as below.

An Example.

The Operation

Operation.

A F 17.5

A D 20

144) 350.00(2.43 Feet

A Note, You may take the Gauge Points upon B, if you pleafe, and you'll have the fame Answer.

Part I.

282)

How to gauge Superficies. Part I. 66 282) 350.00(1.24 Ale Gallons Other Examples. 231) 350.00(1.51 Wine Gallons 2150.4)350.000(.16 Malt Bushel 27.14)350.00(12.8 Hard Soap By the Sliding Rule for Wine Gallons. By the Sliding Rule. As 231 is to 20 fo is 175 to 1.51 Wine Gallons Of the Rhom-4. To gauge a RHOMBOIDES. boides. See Plate 1, Fig. 4. Definition. A Rhomboides hath its opposite Sides and Angles' equal, but the Angles not right, nor all the Sides equal, the Definition. oblong A, F, E, D, is equal to the Rhomboides, as is plain from the Figure. The RULE. The Rule. Multiply the Side A D into the Perpendicular D E, and divide the Product as below, you will have the Area in each respective Quantity. An Example. Example. Let the Side A D be = 20, and the Perpendicular DE = 14.75, I demand the Area in Feet, Ale and Wine Gallons, in Malt Bushels, and Pounds of Green Soap? Operation. Operation. DE=14.75 A D= 20 144) 295.00(2.05 Feet Other Examples. 282) 295.00(1.04 Ale Gallons 231) 295.00(1.27 Wine Gallons 2150.4)295.0000(.137 Malt Bushels 25.67) 295.0000 (11.49 Pounds of Green foft Soas By the Sliding Rule for Malt Bushels. By the Sliding-Rule. 14.75 to .137 Malt Bush. As 2150.4 is to 20 fo is

For Green Soft Soap.

As 25.67 is to 20 fo is 14.75 to 11.49 Pounds of Green Soft Soap

5. To gauge a TRIANGLE. See Plate 1, Fig. 5.

Of the Triangle.

Definition.

Definition. A Triangle is a Figure of three Sides, and as many Angles; if the three Sides be equal, then 'tis called an equilateral Triangle; if two be equal, it is called an Ifofcelar Triangle;

Triangle; if all the Siaes be unequal so that it have no right Angle in it, 'tis called an oblique angled Triangle; they are all measured by one and the same Rule.

The RULE.

1. From any Angle, as B, let fall the Perpendicular † B D upon the Base A C, and multiply half that by the Base, and that Product shall be the Area of the Triangle in the same Parts or Measure that the Dimensions were taken in:

2. Multiply half the Base by the whole Perpendicular: This Product is equal to the Area.

A 2d Rule.

3. Multiply the aubole Base by the whole Perpendicular, and balf this Product is the Area as before.

A 3d Rule.

The Reason of the Rule is, that every Triangle is half the circumscribing oblong, or long Square, &c. as is plain from the Figure.

Euclid 41, 1-

Example. Let the Base A C be 20.787 Inches, and the Perpendicular B D 18; I demand the Area of the Triangle A, B, C, in Feet, Ale Gallons, Wine Gallons, Malt Bushels, and Pounds of foft Soup?

An Example.

Operation. A C = 20.787 \ Inches Half of B D =

The Operation.

144) 187.083 (1.299 Feet

282)187.083(.663 Ale Gallons

231 )187.083 (.809 Wine Gallons

2150.4)187.083(.08 Malt Bufbels

Other Examples.

25.56) 187.083 (7.3 Pounds of white foft Soap

By the Sliding Rule for white foft Soap.

As 25.56 is to 20.79 fo is 9

By the Sliding.

N. B. The Area of a Triangle may be found without knowing the Perpendicular, by having the three Sides given, as in page 26. A Note.

7.3

6. To gauge a TRAPEZIUM.

See Plate 1, Fig. 6.

Of the Trapes

Definition. A Trapezium is any Figure that has four unequal Sides, as Fig. 6, in which the Line A C is called the \* Dia- Definition. gonal, BF and DE are Perpendiculars, which in Fact is no more than two Triangles, viz. A, B, C, and A, D, C.

The A Perpendicular is the Shortest Line that can be drawn from the Angle B, to the Side Diagonal, a Greek Word, from die, Dia, and yaria, gonia, a Corner.

68

The Rule.

# How to gauge Superficies. Part I.

The RULE.

Take your Dimensions in Inches, and multiply half the Sum of the Perpendiculars, by their Bafe or Diagonal AC, and the Product is the Area in Inches; which divide by 144 for Feet, by 282 for Ale Gallons, by 231 for Wine, by 2150.4 for Malt Bushels, and by 40.714 for a Pound of Raw Starch.

Example. Let the Diagonal A C be 78 Inches, D E 23, and B F 15.5; what's the Area in Feet, Ale Gallons, Wine Gal-

lons, Malt Bushels, Pounds of Raw Starch.

The Operation.

An Example.

Operation. DE = 23B F = 15.5The Sum = 38.5 Half the Sum = 19.25 AC = 78

15400 13475 144)1501.50 (10.42 Feet

Other Examples.

282) 1501.50(5.32 Ale Gallons

231)1501.50 (6.93 Wine Gallons

2150.4)1501.500(.69 Malt Bushels

40.714)1501.50000(36.88 Raw Starch

By the Sliding

By the Sliding Rule for Ale Gallons.

As 282 is to 78 fo is 19.25 to 5.32 Ale Gallons For Starch.

As 40.71 is to 19.25 fo is 78 to 36.9 Pounds raw Starch 7. To gauge an IRREGULAR Figure.

See Plate 1, Fig. 7.

Definition. All Figures that have above four Sides, and those unequal, are called, by Geometricians, Irregular Polygons.

The Rule.

Of irregular Fi-Bares.

Definition.

The RULE.

These Figures must be reduced into Triangles and Trapeziums, and gauged, as has been taught in those Figures.

So the Figure before us will be reduced into two Trapezias, by drawing the Line A D: Then let the Dimensions be as in the Figure.

Firft. For the Area of the Trapezium A, D, E, F, G. Operation.

For ABCD. The Operation. Operation. AK = 19.5DI = 29.25 CL = 6.5FH = 13.5Sum = 42.75Sum = 26.0Half = 13 Half = 21.375 GE = 47BD = 4678 149625 85500 A DEFG = 1004.625598

ABCD add 598.

144)1602.6250(11.115 Feet.

282)1602.625 (5.683 Ale Gallons.

231)1602.625 (6.938 Wine Gallons,

2150.4)1602.6250(.745 Malt Bushels.

30.28) 1602.625 (52.9 Tallow Pounds grofs.

By the Sliding Rule, for Wine.

By the Sliding

Other Examples.

Here you must make two Operations, one for each Trapezium, and adding their Areas together, gives the Content of the whole Figure.

First, for the Trapezium, A D E F G,

A.

As 144 is to 21.4 so is 47 to 6.16 Feet.

Secondly, for ABCD.

B.

As 144 is to 46 fo is 13 to 4.15 Feet.

Area A D E F G, add 6.96 Feet.

The Content of the whole 11.11 Feet.

For Ale.

В. As \$2 is to 47 fo is 21.4 to 3.55 As 282 is to 46 fo is 13 to 2.13 Add 2.13

Content, or Area 5.68 Ale Gallons.

8. To gauge Regular Polygons.

Of regular Poly-

See Plate 1, Fig. 8.

Definition. All Figures that have more than four Sides, and those equal, are called Regular Polycons: If it has five equal Sides 'tis called a Pentagon; if it has fix equal Sides 'tis a Hexagon; if seven equal Sides 'tis a Heptagon, &c. as you will the better perceive by the following Table in page 71: from hence it is plain that they take their Name from the Number of Sides that F 3 bounds them.

70 The Rule.

# How to gauge Superficies. Part I.

The RULE.

Find the Area of one of the Triangles, (as has been taught on Page 66;) and multiplying that Area by the Number of Triangles, gives you the Area of the Palygon\*.

An Example.

Example in a Pentagon. Let the Dimensions be as in the Figures: I demand the Area of the Polygon in Feet, Ale, Wine, Malt, and Soap?

The Operation-

Operation.

B A = 36

Half of F G = 12.39

B A = 36

7434

3717

446.04

Number of Sides 5 144) 2230.20(15.48 Feet.

282)2230.20 (7.91 Ale Gallons.

Other Examples.

231)2230.20 (9.65 Wine Gallons.

2150.4)2230.200(1.03 Malt Bushels.

25.67)2230.20c(86.9 Pounds of hard Soap.

By the Sliding.

By the Sliding Rule for Feet.

Set 446 the Area of the Triangle on B to the Divifor 144 on A, and against 5. the Number of Sides on A, is 15.5 on B the Area of the Pentagon in Feet, viz.

A. B. A. B.

As 144 is to 446 so is 5 to 15.5 Feet.

For Ale.

A. B. A. B. A. B. A. B. A. 282 is to 446 so is 5 to 7.91 Ale Gallons.

Or you may fay:
A. B. A. B.
As 282 is to 90 so is 24.78 to 7.91 Ale Gallons.

Or,

As 282 is to 24.78 so is 90 to 7.91 Ale Gallons.

And now that my Reader may have a View of all the Regugular Polygons to Twelve Sides, I have here calculated a Table which is constructed thus.

Find

Some rather choice to multiply half the Sum of the Sides, by the nearest Distance of any Side from the Center, (equal to the Perpendicular,) and divides, or multiply by the Divisors to Factors in the Table; Page 50, and you will have the Area of the Folygon. So BA = 36 = 56 = 150 its \( \frac{1}{2} = 90 \times F G = 24.78 = 2230.20 \) the Area in Inches as above.

Find the Center of a Circle that will circumscribe the Pohygon, then because in every Circle there are 360 Degrees, divide the said Circumserence by the Number of Sides of the Pohygon, and the Quotient is the Quantity of the Angle at the Center, from which Center, let sail a Perpendicular as FG in Figure 8, Plate I. and there is formed a Right angled plain Triangle as AGF = BGF; then supposing the Base BA to be one Inch, BG = GA will be bass an Inch, with the Angles GFA = GFB = 36 Degrees, and FGA = FGB = 54 Degrees given, to find the Perpendicular GF, which by Trigonometry I find the Length of the Perpendicular FG to be .688 Decimal Parts of an Inch, the Area in Square Inches 1.72, in Ale Gallons .006099, in Wine Gallons .007445, and in Malt Bushels .0007998, & c.

### A TABLE of Regular POLYGONS.

Cerne 1 Inch	the ter.	Cen-	dicular.	The Area in Square Inches.	Ale Gal		The Area in Malt Bu- shels.
A Pentagon has 5 Sides	72	00	.688	1 1.72	.006099	.007445	.0007798
An Hexagon has 6 Sides						.011246	.001208
An Heptagon has 7 Sides	51	26	1.038	3.633	.012883	.015727	.001689
An Octagon has 8 Sides	45	00	1.207				.002245
A Nonagon has 9 Sides						.026766	.002875
A Decagon has 10 Sides						.033311	
An Undecagon has 1 1 Sides						.040523	
A Duodecugon has 12 Sides						.048467	

\* Note. These Areas are common Multipliers.

The Use of the preceding Table.

The Use of the Table of Puly-

Multiply the Square of the Side of any Regular \* Polygon Bons. by the common Multiplier of any of the Bodies in the Table; and the Product is the Area of that Body in Feet, Ale Gallons, Wine Gallons, or Malt Bushels respectively.

Example. Let the Area of the Pentagon above, be required An Example, in Feet, Ale, Wine Gallons, and in Malt Bushels?

B A fquar'd =  $1296 \times .0119444 = 15.4$  Feet  $1296 \times .006099 = 7.9$  Ale Gallons  $1296 \times .007445 = 9.6$  Wine Gallons  $1296 \times .0007798 = 1.03$  Malt Bushels

Note, I have purposely omitted the Area in Feet in the Table; but if your Curiosity seads you to require the Area of any Polygon in Feet, you may find Factors for that Purpose by dividing the Area in Inches by 144: and for the Pentagon, it is .119444.

F 4

9. To

Of a Sector of a

9. To gauge a Sector of a Circle.

Definition.

See Plate 1, Fig. 9.

Definition. A Sector of a Circle is a Figure bounded by two Radius's or Semi-diameters of the Circle, having some Part of the Periphery, or Circumference for its Base.

The Rule.

The RULE.

Multiply the Radius or Semi-diameter by half the Arch of the Sector, or the whole Arch-Line, by half the Leg or Semi-diameter, and divide the Product by 144 for Feet, by 282 for Ale Gallons, by 231 for Wine Gallons, and by 2150.4 for Malt Bushels, &c. and you will have the Area in each particular Quantity.

How to find the How to find the Length of any Arch, or Part of a Circle, Length of an avithout measuring of it.

Double the Semi-diameter, and that gives the Diameter of the Circle, of which the Arch B C is a Part; then find the Circumference of the Circle (as has been taught in Page 45) and also the Quantity of the Angle at the Center A, as I have taught in my Mechanick Dialling, Page 72. Then say, As the whole Circumference of the Circle 360 Degrees, is to the whole Circumference in Inches; so is the Arch B C in Degrees, to the Arch B C in Inches.

An Example.

Example. Let the Leg, or Semi-diameter BA = AC be 80 Inches, and the Angle at A 51 Degrees; how many Inches is the Arch BC?

The Operation.

Operation.

A B A B
As 1 is to 3.14159 fo is 160 to 502.654
Unity Circumf. Diam. Circumf.

Then,

As 360 is to 502.654 fo is 51 to 71.2 CB

Degrees Inches Degrees Inches

Now for the Area of the Sector.

By the Sliding Rule.

By the Sliding

10. To gauge a Semi-Circle.

To gauge a Semi-circle.

See Plate 1, Fig. 10.

Definition. A Semi-circle is bounded by the Diameter A C, and half the Circumference A B C.

The RULE.

The Rule.

Multiply half the Circumference ABC = 37.7 by one Fourth of the Diameter, the Product is the Area in Inches, which divide by 144, 282, 231, 2150.4 which gives the Area in Feet, Ale Gallons, Wine Gallons, and Malt Bushels.

Or,

Divide the Square of the Diameter by double the Divisors for Circles, and the Quotients will give you the Areas as before.

Another Rule.

Example. Admit the Diameter A C be = 24 Inches, and the Pen. the balf Circumference A B C = 37.7; I demand the Area of the Semi-circle in Fest, Ale, Wine, Malt, and Pounds of bard Soap?

1. Opera-

### 1. Operation by fquare Inches.

Two feveral ways of finding Half the Circumference A B C= 37.7 the Area.

One Fourth of the Diameter = 6 One Fourth of the Diameter = 144)226.20(1.57 Feet

2. Operation by Circular Inches.

Diameter A C 24 Squared = 576 Divisor 183.34 Half = 288.0000(1.57 Feet

Feet. Alc.

For ALE.

Square Inches 282)226.200(.8021

Circular Inches 359.05)288.000000(.8021

Wine.

For WINE.

Square Measure 231)226.2000(.9792

Circular Measure 294.118)288.0000000(.9792

Malt fquare.

For MALT by Square Inches.

2150.4)226.20000( 1052 Malt Bushels.

Malt round.

By Circular Inches.

2738.)288.0000 (.1052 Malt Bushels

Hard Soap.

For Hard SOAP.

Square and Cir- Thus by Square Measure: Or thus by Circular Measure 27.14)226.2000(8.33 34.56)288.0000)8.33

By the Sliding Rule.

By the Sliding Rule.

Square.

By Square Measure.

B As 144 is to 37.7 fo is 6 to 1.57 Feet 1 Radius Area Arch Divifor

Or.

Circular.

By Circular Measure

D As 13.54 is to 1 fo is 24 to 3.14 Area whole Circle Gauge Pt. Unity Diam. 1.57 Area Semi-circle Gauge Pt.

B

A B A B

As \{ 282 \\ 231 \\ 2150.4 \} \] is to \{ 37.7 \\ 37.7 \\ 37.7 \} so is \{ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 10 \} \{ 8 \\ Mine Gallons \\ 1 \\ Malt Bushels \]

Or,

Half the Square of the Diameter divided by the Circular Divisors in Page 50, will give the same Area as by the other two Methods above:

Or

By the Gauge Points on the Lines C and D in Circular Measure.

Because the Diameter of the Circle is taken, you must take the balf of those Areas for the Area of the Semi-circle, as you see them stand on the Right Hand.

11. To gauge a Quarter of a Circle.

To gauge a Quar, ter of a Circle.

See Plate 1, Fig. 11.

Definition. A Quarter of a Circle is bounded by two Radius's Definition. or Legs, meeting in the Center, and cutting each at right Angles at A, on which the Arch B C is drawn.

The RULE.

The Rule.

Multiply half the Arch by the Radius, or Leg, or half the Leg by the whole Arch; either give the Area in the same Measure the Dimensions are taken in.

When the Dimensions are taken in Inches, divide by the fame Divisors as in the Sector and Semi-circle, and you will have the Area in Feet, Ale, Wine, Malt, &c.

Example. Admit the Leg A B be 12 Inches, and the Arch Pen. B C 18.85; what is the Area in the above mentioned?

Opera-

## How to gauge Superficies. Part I.

The Operation.

Operation.

Arch 18.85 Half B A = 6 144)113.100 (.785 Feet

282)113.100 (.401 Ale Gallons

Other Examples.

231)113.100 (.4896 Wine Gallons

2150.4)113.10000(.0526 Malt Bushels

30.28) 113.10000 (3.735 Pounds Tallow gross

p

A

th

ha

W

an

(th

By the Sliding Rule.

By the Sliding Rule.

For Square Measure.

2. By the Gauge Points on the Lines C and D.

Of the Segment of a Circle. 12. To gauge the Segment of a Circle.

See Plate 1, Fig. 12.

Definition-

Definition. A Segment of a Circle is a Part cut off by a Right Line (less than the Diameter) drawn within the Circle, as EF; so that EAF is a Segment less than a Semi-circle, and FBE is greater than a Semi-circle.

The Rule.

The RULE.

An easy way to From the Segment make a Sector; then the Reason of find the Area of Measuring (or Gauging) the Segment is evident for to find the Area of the Sector G E A E, and also the Area of the Triangle

Triangle GEF; then fubfiract the Area of the Triangle, from the Area of the Sector, and there will remain the Area of the Segment E A F; which if you substract from the Area of the whole Circle, there will remain the Area of the Segment \*FBE.

Because in Gauging a Sector of a Circle, the Length of the Arch Line is required to be known, I shall here add another way than what was shewed in Page 72, to find the same.

The RULE.

The Rule.

Multiply the Chord of half the Arch, viz. AF by 8, and from the Product substract the Chord of the whole Segment, viz. EF; divide the Remainder by 3, and the Quotient is the Length of the Arch very near the Truth.

Example. Let the Chord of half the Arch = A F be 12. and the Chord of the Segment = EF be 20.7846, I Demand the length of the Arch EAF?

An Example.

The Operation. Operation.

AF = 12Common Multiplier Product 96. - 20.7846 3)75.2154(25.0718 = EAF

These things being well understood, the Learner may now proceed to find the Area of the Segment E A F C, according to the Rule given above.

Operation.

A furti jer Opera-

EF 20.7846 EAF = 25.0718: E G = + CG= Area of the Sector GEAF 150.4308 GECF 62.3538 Area Triangle Substract Area of Segment E A F = 88.0770

II. I shall here give a fecond Method of finding the Area of A second way the Segment of a Circle, that so the young Student may not of finding the have any thing wanting to make him a compleat Gauger, Sur-Area of the Seg-ment of a Circle. veyor, &c.

The RULE.

The Rule

1. Square the Semi-diameter or Radius of the Circle A G, and Multiply that Square by 7.

2. Multiply the Radius A G by 4, and that Product by C G, (that is the Difference between the werfed Sine + A C and Radius A G.)

3. Square

\* Several Authors make use of a Table of the Segments of a Circle, but it being not only very common, but also troublesome, for these Reasons it is omitted in this Work.

1 The versed Sine of an Arch is a Segment of the Diameter of a Circle lying between the Foot of the Right Sine, and the lower Extremity of the Arch.

## Dow to gauge Superficies. Part I

3. Square the said Distance C G, and Multiply its Square by 3, add this Product to the Product got by the second Rule, and sub-stract that Sum from seven times the Square of the Radius (or the Product got by the sirst Rule); and what remains is your dividend.

4. Multiply the Radius of the Circle by 4.5, and C G by 3, add these two Products together, and the Sum is the Divisor.

5. Divide the Dividend by the Divisor, and the Quotient; multiply by half the Chord E F, viz. by E C, this last Product is the Area, or superficial Content of the Segment E A F; and so of any other Segment of a Circle whatsoever.

An Example.

Example. Admit the Radius E G = F G be 12 Inches, and the versed Sine A C = 6, the Difference between that and the Radius is CG = 6; I demand the Area of the Segment in Inches, Feet, Ale Gallons, Wine Gallons, Malt Bushels, and Pounds of Green Starch.

The Operation.

Operation.

Ale Gallons 12	Ale Gallons 12 CG	6
12	_4	0
144	48 36	,
Com. Multiplier= 7	6 3	
Product = 1008	2887 _ 108	
Substract = 396	1085	
Dividend = 612	396	
Common Multiplier 4.5	CG 6	
Ale Gallons = 12	3	
Product 54.0 Add 18.	18	
Divifor = 72)612	.0(8.5	
EC = 10.3923		
Quotient, is a Multiplier=8.5		
519615 831384	real and the second second	
Area 88.33455	Inches, which differs	s but

Area 88.33455 Inches, which differs but .26758 hundreth thousandth Parts of an Inch, from the Area found by the other Rule above-mentioned; that is but a little more than a Quarter of an Inch.

144

144)88. 33455(.61343 Feet

Other Examples.

282)88.33455(.31324 Ale Gallons

231)88.33455(.3824 Wine Gallons

2150.4)88.33455(.041 Malt Bushels

40.714)88.33455(2.17 Green raw Starch Pounds

Upon Hunt's Sliding \* Rule.

On Hunt's Slid-

For, as the Diameter 24 on A, is to 100, on the Segments, So is the versed Sine A C = 6, to the Segment 19.5.

Then, as I on B, is to the Area of the Circle 452.4 on A, So is the Segment on B, to the Area of the Segment on A = 88. Inches.

1. Having the Diameter of a Circle, and the Chord of its Segment, to find the versed Sine C A.

The RULE.

The Rule.

From the Square of the Radius EG fubstratt the Square of EC, the Square Root of the Remainder is CG, then AG = CG = AC.

Alfo,

2. By having the Chord E F, and the versed Sine A C given to find the Diameter A B.

The RULE.

The Rule.

As A C is to E C fo is E C to C B, to which add A C the versed Sine, the Sum is the Diameter. Euclid 6, 13.

3. The Diameter A B, and the werfed Sine A C being given to find the Chord E F.

The RULE.

The Rule.

From balf the Diameter = AG 12, Substract AC = 6, there remains CG = 6: Then from the Square of EG Substract the Square of CG, the Square Root of the Remainder is EC, which doubled gives EF the Chord Sought.

You may divide these Dividends by their proper Divisors, as has been taught in Page 38, or by finding the Area of each Circle, and their Difference will be the Area of the Space.

By the Sliding Rule.

A B A B B A B A B A 6 is to 10.3923 fo is 10.3923 to 18+6= 24

13. To

\* Upon Hunt's Sliding Rule there is a Line of Segments, by which the Area of the Segment of a Circle may be found, as he shows in his Mathematical Companion, Pages 168 and 169.

# Dow to gauge Superficies. Part I.

The Space D B.

13. To Gauge the Space D B.

See Plate 1. Fig. 12.

. Definition.

Definition, Concentric or Parallel Circles, are such as have the fame Center, as the Circles A and C have both the fame Center at G.

The Rule.

The RULE.

From the Area of the greater Circle, fubstract the Area of the leffer Circle; the Remainder will be the Area of the Space D B.

An Example.

Example. Let the Diameter AB be 24, CD 12 Inches, what's the Area of the Space DB?

The Operation.

Operation.

Area of SAB = 452.4
the Circle CD = 113.1

144)339.300(2.356 Feet

Other Examples.

282)339.300(1.203 Ale Gallons

231)339.300(1.467 Wine Galions

2150.4)339.30cc(.157 Male Bushels

Of the Ellipfis, or Oval.

14. To Gauge an Ellipsis, or Oval.

See Plate 2, Fig. 1.

Definition.

Definition. An Ellipsis is encompassed by a Curve Line in which there is not any Part of a Circle; 'tis generated from the Section of a Cone, cut by a Plane obliquely thro' the Axis, is longer one way than the other; the longest Diameter A D is called the Transverse, and the shortest GF the conjugate Diameter, Plate z. Fig. 8, LF is an Ellipsis by cutting the Cone.

It is also a Geometrical Mean between two Circles, whose Diameters are equal to the Transverse and Conjugate Diameters

of the Ellipfis.

Hence it is easy to conceive, that the Square Root of the Rectangle or Product of the Transverse and Conjugate Diameter, will be the Diameter of a Circle, whose Area will be equal to the Ellipsis Area.

Note, every Ellipsis has two Focal Points, viz. I and K, through which the Latus Redums BH and CE do pass cutting the Transverse Diameter at right Angles; and for their Length it will always hold thus:

AD GF GF BH = CE As 61 is to 37.5 fo is 47.5 to 37 fere.

The

li di (a

The RULE.

The Rule.

If you multiply the Transverse by the Conjugate Diameter, and divide the Product by the Circular Divisors, it will give the Area in the same Measure.

Example. Let the Transverse Diameter A D be 61 Inches, and the Conjugate Diameter G F 47.5; I demand the Area in Feet, Ale and Wine Gallons, in Malt Bushels, and in Pounds of soft Soap?

An Example.

.

Operation.

The Operation-

$$GF = 47.5 
AD = 61$$

$$475$$

$$2850$$

183.34)2897.5000c(15.804 Feet

359.05)2897.5000 (8.07 Ale Gallons

Other Examples.

294. 118)2897. 50000(9.85 Wine Gallons

2738.)2897.50 (1.05 Malt Bushels

32.54)2897.5000 (89.04 White Soft Soap

By the Sliding Rule.

By the Sliding

15. To gauge the Segment of an Ellipsis. Of the Segment of an Ellipsis.

See Plate 2, Fig. 1.

0

You must remember that I have told you before, every Ellipsis is a Geometrical mean Proportional between the Two Circles Ellipsis described on the Transverse and conjugate Diameters: So that (as before has been taught) if you find the Area of the Circle whose Diameter GF = 47.5 it will be 1772.05 Square Inches:

Also the Area of the Circle \* whose Diameter AD = 61 = to the Transverse Diameter of the Ellipsis, it will be 2920; the Geometric Ge

\* Note. You need not find the Areas of the Circle and Ellipsis; but instead thereof, mak? Use of the Transverse and Conjugate Diameters of the Ellipsis.

Geometrical Mean between these two Areas is 2275, the Area of the Ellipsis in Square Inches.

A Symphis of the Here follows a short View of the several Parts of the parts of an Ellip-necessary to be known in the Gauging of its Segments. Here follows a short View of the several Parts of the Ellipsis, Segments.

A D = 61.  
GF = 47.5  
GI = A L = 30.5  
IL = B q = 19.2 - 
$$\left| -q \right|$$
 C = BC 38.4  
A I = 11.3  
BH = CE = 37.  
LP = LG = 23.75  
qL = B I = 18.5  
O q = q P = 14.89  
SI = Ir = 23.7  
Sr = vt = 47.4

Plate 2. Fig. 1. Now let it be required to find the Area of the Segment To find the Area B G C = H F E: in order to do which we must have in Readiof a Segment. Now let it be required to find the Area of the Segment ness the Latus Rectum, BH=CE which by the 14th Section hereof I found to be 37.

And from hence it follows, that all Segments of an Ellipsis and its inscribed Circle whose Bases are parallel to the Transverse Diameter, and have the same Height, are in Proportion

one to another as their Areas are. That is,

As the Area of the inscribed Circle, is to the Area of the Ellipsis, so is the Area of the Circle OPG, to the Area of the Ellipsis BGC. But first we must have in Readiness half the Chord \* of the Arch OGP, viz. Oq = Pq. which I find in the Triangle L P q, for there is given, L P = 23.75, being the Radius of the inscribed Circle, and L q = 18.5, to find q P, which by the 47 of the first Book of Euclid, (as I have noted in Rule 3, page 25) I find to be 14.89.

These Things being known, proceed to find the Area of the Circle's Segment O G P, by the 12th Section hereof; which I find to be 105.80834. Now fay, as the conjugate Diameter G F, is to the Area of the Circle's Segment, so is the Transverse Diameter A D, to the Area of the Ellipsis Segment BG C.

or equals, and help have have the first that

E aı

<sup>\*</sup> Chord in Geometry is a Right Line connecting the Extremities of any Arch of a Circle, and is like the String of a Bow, as in Plate 2, Fig. 1. Sr, is the Chord of the Arch SAr; and twis the Chord of the Arch t Dw: OP is the Chord of the Arch OGP. And wx is the Chord of the Arch w Fx, &s.

See the Work.

Operation

162.375)1164.1875(7.106 × qP = 14.89 = 105.80834

Now fay:

GF Seg. OGP AD Seg. BGC

As 47.5 is to 105.80834 fo is 61 to 135.8802

Which doubled is the Sum of the Segment BGC 271.7604

2. For the Area of the Segment HAB=CDE. Of the Area of

See Plate 2, Fig. 1.

Before we can proceed in this, we must find the Length of How to proceed. the Chord of the Arch S Ar = t Dv, viz. r s = t v.

And because SI = v K, is a mean Proportional between AI and ID (as is plain from the Figure) I find it to be 23.7.

Now observe to work as in the 12th Section hereof, and find

Now observe to work as in the 12th Section hereof, and find the Area of the Circle's Segment, and by that the Segment of the Ellipsis, as you may the better perceive by the following Example.

G 2

AL 30.5

# Dow to gauge Superficies. Part I.

$$194.85)3063.430(15.72 \times 23.7 = SI = 372.564 = SAr.$$

### Now fay:

1420.8

SAr and vDt =

Seg. BG Cand HFE

Area of the Oblong BCEH =

Sum are Square Inches in the Ellipsis

A Proof of the Gauging the El. Now if these Square Inches be divided by the Square Divilips and its Seg-fors for Feet, Ale, Wine, Malt Bushels, &c. we shall have the ments.

Area of the Ellipsis in those Measures, as was found in Page 81, when we gauged the Ellipsis; which is a Proof of all the Operations concerning the Ellipsis and its Segments.

Feet. 144)2272.783(15.783 Feet

Ale. 282)2272.783(8.059 Ale Gallons

Wine. 231)2272.783(9.839 Wine Gallons.

Malt. 2150.4)2272.783(1.05 Malt Bushels

25.56)2272.783(88.9 Green soft Soap.

By the Sliding Rule.

By the Sliding Rute.

To gauge a PARABOLA.

Of a Parabola.

See Plate 2, Fig. 2.

Definition. A Parabola is one of the Conic Sections generated Definition. by cutting the Cone with a plain Parallel to the Side thereof. Thus Plate 2, Fig. 8. if the Cone be cut by the right Line GH parallel to the Side AB, that Section will be a Parabola as represented by Fig. 2. Plate 2. And every Parabola is  $\frac{2}{3}$  of its circumscribing Parallelogram; i. e. ABC is  $\frac{2}{3}$  of AE FG; and the Triangle ABC is \(\frac{3}{4}\) of the Parabola, which Thing may be easily proved, if we consider that AE and and CF are each equal to BD; and that the Square of BC is equal to the Sum of the Squares of B D and D C. Q E D.

The RULE.

Take your Dimensions in Inches and Decimal Parts; and multiply the Base A C by the Perpendicular B D, and divide the Product by 216 for Feet. by 423 for Ale Gallons, by 346.5 for Wines, by 3225.6 for Malt Bufbels, and by 45.42 for Tallow Pounds, &c. the feveral Quotients will be the Area of the Parabola in every respective Measure.

The Rule.

How to find the Divisors for a Parabola.

But first, I shall shew how the above Divisors are found.

How to find the

Feet 216. 423. Ale Gallons Wine Gallons 346.5 3225.6 Malt Bushels 45.42 Tallow Pounds Divifors Content Proportion

Example. Admit the Base of the Parabola A C be 40 Inches, and the Perpendicular or Axis DB 30 Inches; what's the Arca of the Parabola in the Measures above mentioned?

An Example.

The Operation.

Operation.  $\Lambda C = 40$ BD = 30

216) 1200.00(5.55 Feet

Feet

423)1200.00 (2.84 Ale Gallons

346.5) 1200,000 (3.46 Wine Gallons

Wine:

3225.)

Part I.

Malt Bufnels.

3225.6)1200.000(.37 Malt Bushels

Tallow.

45.42)1200.000(26.4 Tallow Pounds gross

By the Sliding-

By the Sliding Rule on A and B.

Note. That the 40 in the Proportion above is the Quantity of the Base of the Parabola, and the 30 is the Axis thereof.

Of an Hyperbola.

17. Of an HYPERBOLA +.

See Plate 2, Fig. 8.

Definition.

Definition. An Hyperbola is the 5th Section of a Cone, cut by a plain Parallel to the Axis, and continued till it meet the other Side of the Cone, beyond the Vertex, which is reprefented by N.

Of the Propor

As N K x D K 
$$\begin{cases} A & K & q \\ A & K & q \end{cases}$$
 is 
$$\begin{cases} Na \times Da \\ Nb \times Db \\ Nc \times Dc \\ Nd \times Dd \\ Ne \times De \\ Nf \times Df \end{cases}$$
 to 
$$\begin{cases} ga & q \\ hb & q \\ hb & q \\ kd & q \\ le & q \\ mf & q \end{cases}$$

The Square Root of which, are the Distances ga, ht, &c. in the same Parts as A B is 60.

And thus finding as many Ordinates as you please, or as you see necessary, the Points g, b, i, k, l, m, n, o, p, q, r, s, will be in the Hyperbola.

Of the Area.

Now the next Thing in order, is to find the Area of the Hyperbola; but because that cannot be exactly performed by any certain or settled Theorems, as these of the Circle, Ellipsis, and Parabola have been; I shall therefore omit it till such Time as the squaring of the Hyperbola is better ascertained.

18. To

In the Hyperbola, if K I be continued to the Vertex of the Cone at M, it will make K M = 96, and if we continue it, till it meet with the other Side of the Cone A B (which I here note with N) then will NK be equal to 150.

18. To gauge a Cycloid or Trochoid.

Of a Cycloid.

See Plate 2, Fig. 3.

Definition. The Curve of this Figure is called by Mathematicians a Transcendant Curve, or a Line of infinite Order. And may best be conceived to be generated by a Nail in a Coach Wheel; for in every Revolution of the Wheel, this Curve is described: And the whole Cycloidal Curve Line is equal to 4 Diameters of the generating Circle; and the Area of the Cycloidal Space is equal to 3 Times that Circle. There are many curious philosophical Experiments depending upon this Curve; but they being foreign to the present Work are therefore omitted.

Definition.

To delineate a Cycloid.

To delineate a

Make the Diameter of the Circle D B of what Quantity you please, as suppose so; then will the Circumserence be 188.4954 of the same Parts; and the Semi-circumserence 94.2477; divide the one half of the Circle into any Number of equal Parts (the more the better) suppose 12 in the Points F, G, H, I, K, L, M, N, O, P, and divide the half Base A B into the like Number of equal Parts; through the equal Points in the Arch draw Lines parallel to A C, and lay B P from E to k, B q from F to i both-ways, &c. So will a, b, c, d, e, f, g, b, i, k, be all in the Cycloid.

The RULE.

The Rule.

Find the Area of the generating Circle, and multiply it by three, this gives the Area of the Cycloidal Curve in Inches; which dividing by the proper Divisors, or multiplying by the proper Factors will give the Area in Feet, Ale, Wine, Malt, &c.

Example. Let the Diameter of the generating Circle be 60 Inches: What's the Area of the Cycloidal Space?

An Example.

# How to gauge Superficies. Part I,

The Operation.

Operation.

Diameter 60 Circumf. 188.4954 Half Circ. 94.2477 Half Diameter 30

Multiply always by 2827.4310

Feet. 144) 8482.293(58.904 Feet

Ale. 282) 8482.293 (30.078 Ale Gallons.

Wine. 231) 8482.293 (36.717 Wine Gallons

Malt. 2150.4) 8482.29300(3.9444 Malt Bushels

Starch. 40.714) 8482.29300(208.32 Raw Starch

By the Sliding Rule. By the Sliding Rule. D D 760 19.655 x 3 = 58.905 Feet, 13.54 18.94 10.026 x 3 = 30.078 Ale Gallons. 60 560 12.239 x 3 = 36.717 Wine Gallons. 17.14 60 1.31 x 3 = 3.944 Malt Bushels, 52.32 60 69.44 x 3 = 208.32 Pounds of green 7.2 Gauge Pt. Diam. Starch Unity

A Spherical Triangle.

19. To gauge a SPHERICAL TRIANGLE.

Sce Plate 1, Fig. 16.

A curious Problem not useful in the Surface of a Globe, and is bounded by the Arcs of three great
Gauging,

Circles of the Sphere. I well know this is foreign to the present
Work; yet not doubting but that it may fall into the Hands of
fome, who are Astronomically inclined, it has gained a Place here.

### The RULE.

The Rule for Gauging a Spherical Triangle.

From the Sum of the three Angles, substract a Semicircle, or 180 Degrees, and multiply the Remainder by the superficial Content of the Sphere or Globe: Divide the Product by 720, the Quotient is the Area of the Triangle.

An Example. Example. The Angle P 135, 45, 32, their Sum 212—
180 = 32, and suppose the Diameter of a Globe 60 Inches, its
Circumference 188.9724, the superficial Content 11309.724 x 32,

and divided by 720 = 502.654 square Inches, which you may bring into Feet, &c. as has been taught in Page 52.

### CHAP. XXI.

Shewing how to gauge all Sorts of SOLIDS. Of gauging So-



S Superficies are comprehended under Length and Breadth; so are Solids under Length, Breadth, A Solid what? and Depth.

I. To gauge a Cube. See Plate 2, Fig. 4.

Of the Cube.

Definition. A Cube (or Die) is a Solid having Definition. fix equal Sides.

#### The RULE.

Take your Dimensions in Inches, and multiply the Length, The Rule for Breadth and Depth one into another; this will give you the Solidity in square Inches; which multiply, or divide by the proper Square Factors or Divisors in Page 50, and it will give you the Content in Feet, Ale, Wine, Malt, &c. accordingly.

Example. Let the Side of the Cube be 30 Inches; I demand the Content in Feet, Ale Gallons, Wine Gallons, Malt Bushels, and in Tallow Pounds gross.

Operation.

The Operation.

A B 30 B C 30 Area = 900 CD =30 1728.) 2700000(15.62 Feet Feet, 282)27000.00(95.74 Ale Gallons Ale. 231)2700000 (116.88 Wine Gallons Wine. 2150.4)27000.000(12.55 Malt Bushels Malt. 30.28)27000.0000(89167 Pounds of Tallow gross Tallow gross. 31:4)27000.000 (859.87 Pounds of Tallow neat Tallow neat 27.14)27000.0000(994,43 Pounds of Hard Soap Hard Soap.

25.67

Green foft Soap. 25

25.67)27000.0000(1055.70 Pounds of Green Soft Soap

White foft Soap.

25.56)27000.0000(1056.33 Pounds of White Soft Soap

Green Starch. 40.714)27000.00000 (663.16 Pounds of Green or Raw Starch

By the Sliding- By the Sliding Rule on C and D.

D	C	D	C	
(41.6)	(30)	(30)	15.62 Fee 95.74 Ale	
315.19	30>	30	116.88 Wi	ne Gallons
A (49.30) is to		is (30) to (	891.67 Tal	low Pound gross
5.0	30	$\binom{30}{30}$	994.43 Pos	nds of Tallow neat
5.05	300	300 5	1056.33 Pou	nds of Green soft Soap nds of White soft Soap
Gauge Pt.	Side.	Side.	Content.	nds of Green or Raw (Starch.

A Note.

Note. The first Terms under D, are the Gauge Points for Squares, taken out of the Table on Page 47, the second and third Terms are the Dimensions of the Cabe.

Of the Parallele-

2. To gauge a PARALLELEPIPEDON.

See Plate 2, Fig. 5.

A Parallelepipedon what. Definition. A Parallelepipedon is a folid Figure contained under fix Parallelograms, the opposite Sides of which are parallel and equal.

#### The RULE.

The Rule for Gauging a Parallelepipedon.

a Paral Multiply the Length, Breadth, and Depth one into another (as before in the Cube,) and the Product is the Solidity in Inches; which divide by the preper Divisors you would have its Content in, and you will have your Defire.

An Example. Example. Let the Length A B be = 81 Inches, the Breadth A G = 25, and the Depth G F = 26, What's the Content in Feet, Ale, Wine, Malt, and Tallow Pounds neat?

Operation.	The Operation
$ \begin{array}{c} A B = 81 \\ A G = 25 \end{array} $	
162	
Area = 2025 $GF = 26$	
12150 4050	
1728)52650.00(30.46 Feet	Feet.
282)52650.0 (186.7 Ale Gallons	Ale.
231)52650.00 (227.92 Wine Gallons	Wine.
2150.4)52650.000(24.48 Malt Bufkels	Malt.
31.4)52650.000(1676.75 pounds of Tallow neat	Tallow neat.
30.28)52650.0000(1738.77 pounds of Tallow groß	Tallow gross.
27.14)52650.0000(1939.94 pounds of bard Soap	Hard Soap.
25.67)52650.0000(2051.03 pounds of green soft Soap	Green foft Seap.
25.56)52650.0000(2059.85 pounds of white fost Soap	White foft Soap.
40.714)52650.00000(1293 16 pounds of green or raw Starch	Starch.
By the Sliding Rule	By the Sliding.

By the Sliding Rule.

By the Sliding-

Before this can be performed, you must find a Geometrical A Geometrical mean Proportional between the Length A B 81, and the Breadth Mean. A G 25, as has been taught in page 43 on the Lines C and D, thus:

D C C D

As 81 is to 81 fo is 25 to 45 the Mean

The Length. Breadth.

Now for the Content fay :1

D .	C	D	C			
41.6 16.79 15.19 46.37 5.6 5.5 5.2 5.06 5.05 6.38 Gauge Pt.	26 26 26 26 26 26 26 26 26 26 26 26 26 2	45 45 45 45 45 45 45 45 45 45 45 45 45 4	227.9 24.48 167.67 1738.77 1939.94 2051.03 2059.85	Ale Gallons Wine Gallons Malt Bufbels Tallow pounds of Tal pounds of har pounds of gree pounds of gree pounds of gree pounds of gree	ds neat llow gro d Soap n soft So ite soft So	ap oap

Of the Prism.

3. To gauge a PRISM +.

See Plate 2, Fig. 6.

Definition.

Definition. A Prism is a solid Figure contained under several Planes whose Bases are regular Polygons (most commonly Triangular,) equal, parallel, and a-like situated: so that when the Cube is 1728, the Prism is 748.2456.

The Rule.

The RULE.

Find the Area of the Triangular End A, B, D (as was taught in page 59,) which multiplied by the Length D F, gives you the Solidity in Inches; which reduce into Feet, Ale, Wine and Malt, &c.

An Example.

Example: Admit A B be 63, C D 14, and D F So Inches; I demand the Content as above mentioned?

Operation.

A B = 63 Half of C D = 7 Area = 441 D F = 80

Feet.

1728)35280.00 (20.41 Feet

Ale.

282)35280.00 (125 10 Ale Gallons

Wine.

231 )35280.00 (152.72 Wine Gallons

Malt.

2150 4)35280.000 (16.46 Malt Bufbels

Hard Soap.

27.14)35280 0000 (1299.93 bard Soap

30.28

<sup>†</sup> Note. That Pyramids, Prisms, and Parallelepipedons upon the same Base and Altitude, are as one, one and an balf, and three: That is, it the Pyramid be 1, the Prism is 1 and an half, and the Parallelepipedon is 3.

30.28)35280.0000(1165.12 pounds of Tallow gross Tallow gross.

31.4)35280.0000 (1123.56 pounds of Tallow neat Tallow neat.

25.67)35280.0000(1374.36 pounds of green foft Soap Green soft Soap.

25.56)35280.0000(1380.28 pounds of white soft Soap White soft Soap.

40.714)35280.00000(866.53 pounds of green or raw Starch Green Starch.

By the Sliding Rule on the Lines C and D.

By the Sliding

You must first find a Geometrical mean Proportional between the Base A B 63 and \( \frac{1}{2} \) the Perpendicular C D 7, thus:

D C C D

As 63 is to 63 so is 7 to 21 the mean Proportional.

Base Base ½ Perpend.

Now fay for the Content.

****	C	D	\ C	D.	
S.M	( 20.41 Feet	(21)	(80)	(41.6)	5
	125.1 Ale Gallons	21/	80/	16.79/	1
100000000000000000000000000000000000000	152.72 Wine Gallon	215	< 80 >	<15.19>	
	16.46 Malt Bufbel	)21(	)80(	)46.37	
the gots.	(1299.93 bard Soap	. (21)	(80)	4 (5.2)	A.
low gross	(1165.12 pounds of Ta	is (21) to	10 180 10	( 5.5 ) "	13
low neat	1123.56 pounds of Ta	21/	80/	5.6	
n soft Soap	< 1374.36 pounds of gre	215	380	35.06	
te foft Soap	) 1380 28 pounds of wh	)21(	)80(	) 5.05(	
en or raw	866.53 pounds of gr	(21)	(80)	(6.38)	
(Starch	Content	Mean	Depth	Gauge Pt.	

4. To gauge a CYLINDER +.

Of the Cylinder.

See Plate 2, Fig. 7.

Definition. A Cylinder a Figure like the Rolling-Stone used in Gardens, it is in all Places of an equal Diameter: and in Gauging, all Casks are generally reduced to this Form, before their Contents be given.

The RULE.

The Rule.

Multiply the Square of the Diameter by the Depth (or Length, which you please to term it,) and divide that Product by the proper Divisors for Circles, as you have them in the Table on page 50; and the Quotient is the Content.

Multiply the Product by their proper Factors, which gives you the same Content.

Example.

† A Cylinder is a folid Body made by the Retation of a rectangled Parallelogram round one of its Sides.

# How to gauge Solids.

Part I.

An Example. Example. Let the Diameter A B be 56.5 Inches, and the Length 96: What's the Content in Feet, Ale, Wine, Malt, & c.?

The Operation.

Operation.
AB = 56.5 $56.5$
2825
3390 2825
Length = 96
1915350 2873025

Feet. 2200.158) 306456.00000(139.29 Feet

Ale. 359.05)306456.0000(853.52 Ale Gallons

Wine. 294.118)306456.00000(1041.94 Wine Gallons

Malt. 2738.)306456.00(111.92 Malt Bufbels

Green foft Soap. 32.68)306456.0000(9238.29 green foft Soap

Tallow gross. 38.55)306456.0000(7949.57 pounds of Tallow gross

Tallow neat. 39.98)306456.0000(7665.23 pounds of Tallow neat

Hard Soap. 34.56)306456.0000(8867.36 pounds of hard Soap

White fost Soap. 32.54)306456.000c(9417.82 pounds of white fost Soap

Green Starch. 51.838)306456.00000 (5911.82 pounds of green or raw Starch.

By the Sliding By the Sliding Rule on the Lines C and D. Rule.

As the Gauge Point on D, is to the Depth on C, so is the Diameter on D, to the Content on C.

D	, C	D	C
(46.9)	(96)	(56.5)	( 139.29 Feet
18.94/	)96/	56.5/	853.52 Ale Gallons
As (17.14)	is to < 96 > So	is < 56.5 > to	1041.94 Wine Gallons
152.32	196(	/56.5	) 111.92 Malt Bushels
1 5.7 )	(96)	(56.5)	(9377.47 Green soft Soap
Gauge Pt.	Depth.	Diam.	Content.

D C D C

6.2

6.3

6.3

6.3

796

6.5

6.5

7949.57 pounds of Tallow Grofs,
7665.23 pounds of Tallow Neat,
8867.36 pounds of bard Soap,
96

7.2

Gauge Pt. Depth. Diam. Content.

Note. By help of the Table in Page 59, the Content of the Having only Cylinder may be found by having the Circumference and Length the Circumference only. As for find the Contents

Example. The Diameter of this Cylinder being 56.5 the Cir- An Example. cumference is 177.499835: Then for the Solidity in Feet by the Sliding Rule on the Lines A and B. Say,

A. B. A. B.
As 147.36 is to 177.5 so is 96 to 115.63
Say again:

A. B. A. B. B. A. B. As 147.36 is to 177.5 fo is 115.63 to 139.29 Feet.

5. To gauge a CONE \*.

Of the Cone.

An excellent Way to measure round Timber tru-

ly, with once Set-

ting the Rule.

See Plate 2. Fig. 8.

Definition. A Cone is a folid Figure rising from a Circle by the Rotation of a Triangle round one of its Sides, and terminates in a Point at the Top, called its Vertex; a Cone is equal to one third of its circumscribing Cylinder, as is plain from the Figure.

The RULE.

Square the Diameter A C, and multiply that by one third of A Rule for the Altitude BD; divide this last Product by the proper Divisors Gauging a Cone. for Circles, or multiply it by their proper Factors; and it gives the Content in Feet, Ale, &c.

You may multiply the Square of the Diameter by the whole Another Rule. Height, and divide by the Triple of the circular Divisors, which gives the same Answer.

Example. Let the Diameter of the Base A C be 56,5 Inches, and the Height B D 96; I demand the Content in Feet, Ale, Example. Wine, Malt Eushels and Pounds of soft Soap? Opera-

\* A Cone (by Mathematicians) is called a Pyramid of infinite Sides. And the Surface of a Cone is equal to a Triangle whole Height is the Side of the Cone, and the Base equal to the Circumference of the Base of the Cone. Finding the Area of this, is only useful in Painters Work.

```
Operation.
A C = 56.5
56.5
2825
3390
2825
3192.25
3192.25
638450
957675
```

Feet. 2200.158)102152.00000(46.43 Feet.

Ale. 359.05) 102152.0000(284.51 Ale Gallons.

Wine. 294.118)102152.00000(347.32 Wine Gallons.

Malt. 2738.)102152.00 (37.31 Malt Bulbels.

White foft Soap. 32.54) 102152.0000(3139.28 white foft Soap.

Tallow gross. 38.55)102152.0000(2649.85 Pounds of Tallow Gross.

Tallow neat. 39.98) 102152.0000(2555.08 Pounds of Tallow Neat.

Hard Soap. 34.56) 102152.0000(2958.68 Pounds of hard Soap.

Green foft Soap. 32.68) 102152.0000(3125.82 Pounds of Green foft Soap.

Green Starch. 51.814) 102152.00000(1971.51 Pounds of green or raw Starch.

By the Sliding

By the Sliding Rule on the Lines C and D.

Set the Gauge Point on the Line D, to \(\frac{1}{3}\) of the Altitude on C, and against the Diameter on D, is the Content on C.

D.	C.	D.	C. See State of the state of
546.9	$\left\{\begin{array}{c} 3^{2} \\ 3^{2} \\ 3^{2} \end{array}\right\}$	56.5	5 46.43 Feet, 284.51 Ale Gallons,
As 5.7 Sis	$\left\{\begin{array}{c} 3^{2} \\ 3^{2} \\ 3^{2} \end{array}\right\}_{6}$	56.5 56.5 56.5	347.32 Wine Gallons, 37.31 Malt Bushels, 3139.28 Pounds white soft Soap.
$\left\{\begin{array}{c} 6.2 \\ 6.3 \\ 5.9 \end{array}\right\}$	$\begin{cases} \frac{32}{32} \\ \frac{32}{32} \end{cases}$	$\begin{cases} 56.5 \\ 56.5 \\ 56.5 \end{cases}$	2649.85 Pounds of Tallow Gross, 2555.08 Pounds of Tallow Neat, 2958.68 Pounds of bard Soap,
2 5.72 5.72 5.72 S	${{32}\atop{32}}$	256.5 56.5	3125.82 Pounds of green soft Soap, 1971.51 Poundsofgreenor rawStarch
Gauge Pt.	1 Height	Diam.	Content
			Mark

Mark well. In the Cylinder and Cone I have put the Dimenfions the fame; fo that you see the Cone holds just one third part of the Cylinder.

# 6. To gauge the Frustum of a CONE.

Of the Fruflum of a Cone.

See Plate 2. Fig. 8.

Definition. A Frustum is that Part of the Cone towards the Base when the Top is cut off: So in the Figure before us, if we cut the Cone off by the Line E F, I say the part A E F C is a Frustum, and E B F remains a Cone as before, though of a smaller Size.

Definition.

The RULE.

To three times the Rectangle of the two Diameters, add the Gauging the Fru-Square of their Difference; multiply this Sum by the Depth, and flum of a Cone. divide by 1077.15 (that is 3 Times 359.05) for Ale, and by 882.354 for Wine, and by 8214 for Malt Bufbels, and by 155.514 for Pounds of Green Starch, &c.

Another Rule.

Find the Area of both Ends in Inches, and between them find a Geometrical Mean: The Sum of these three multiplied by 3 of the Altitude of the Frustum gives the Content, which may be reduced into Feet, Gallons, &c.

An Example.

Example, Let the bottom Diameter be 56.5 Inches, and the Top 19, and the Height 62, I demand the Content in Feet, Ale Gallons, Wine Gallons, Malt Bushels, and Pounds of raw Starch?

Operation.

Operation.

A C = 56.5
E F = 19

5085
565

Rectangle 1073.5
Multiply by 3

add 
$$\begin{cases}
3220.5 \\
1406.25
\end{cases}$$
Depth 62

925350
2776050

A C = 56.5
E F = 19.

Subtract 37.5
Difference.

1875
2625
1125
1406.25

Feet

6600.474)286858.50000(43.46 Feet,

1077.15)286858.5000(266.31 Ale Gallons,

Ale.

882.354)286858.5000 (325.1 Wine Gallons,

Wine,

H

8214

If you take the Square Roots of the Divisors for Circles, they will be Gauge Points, by which, and the three Diameters you may find Areas; then the Sum of those three Areas multiplied by the whole Depth will produce the true Content. For the Gauge Points fee Page 50.

Malt.

8214)286858.50(34.92 Malt Bufbels,

Green Starch.

155.514) 286858.50000 (1844.58 Green or raw Starch,

Tallow grofs.

115.65)286858.5000(2480.40 pounds of Tallow Gross,

Tallow neat.

119.94)286858.5000(2391.71 pounds of Tallow Neat,

Hard Soap.

103.68)286858.5000(2766.76 pounds of hard Soap,

Green foft Soap.

98.04)286858.500c(2925.93 pounds of green soft Soap,

White foft Soap.

97.62)286858.5000(2938.52 pounds of white soft Soap.

By the Sliding

By the Sliding Rule.

First, according to the Directions given in Page 43, find a mean Diameter between the Top and Bottom Diameters, on the Lines C and D, thus:

D C C D
As 56.5 is to 56.5 fo is 19 to .32.7 the mean Diameter.

Secondly, to these three Diameters, find Areas by the Sliding Rule, as is taught in Page 33. For the Areas in Feet the Work will stand thus:

D C D C 19. 32.7 to \[ \frac{164}{.485} \] Areas. Sum \[ \frac{2.099}{2.099} \]

of the Height 20.7 Inches.

14693 4198

Content of the Frustum

43.4493 Feet.

Thus by the Rule on the Lines A and B.

B A B A
As 1 is to 2.1 fo is 20.7 to 43.4 Feet.
Unity Area 1 Height

For Ale or Beer Gallons.

Ale and Beer Gallons.

D C
As 18.95 is to 1, so is \[
\begin{cases}
0 & C & \\
19. & \\
32.7 & \\
56.5 & \\
6.5 & \\
6.65 & \\
\end{cases}
\]
Areas in AleGal.

The Sum of the Areas 12.90.

Then as 1 is to 12.9 fo is 20.7 to 266.31 Content in Ale Gallons Unity. Area. \(\frac{1}{3}\) Height. For

```
For Wine Gallons.
              C
                        · D
    D
                      C19.
                                           Areas in Wine Gallons
As 17.14 is to 1, fo is
                                 (10.85.
                      C 56.5.
Gauge Pt.
           Unity
                      Diam.
           The Sum of the Areas
                                    15.74
Then fay, As 1 is to 15.74 fo is 20.7 to 325.1 Content in Wine Gallons
                             1 Height.
          Unity
                    Area
                          For Malt Bushels.
                      D
    D
As 52.32 is to 1, fois
                                         Areas in Malt Bushels.
Gauge Pt.
                      Diam.
            Unity
            The Sum of the Areas 1.69
Then fay, As 1 is to 1.69 fo is 20.7 to 34.92 the Content in Malt Bushels.
                             Height.
                    Area
                       For Pounds of Tallow Grass.
     D
                                          Areas in Pounds of Tallow Grofs.
As 6.21 is to 1 fo is
                                (82.74.
Gauge Pt. Unity
                       Diam.
          The Sum of the Areas 119.82
Then fay, As 1 is to 119.82 fo is 20.7 to 2480.4 Content in Pounds Tal. Grofi.
                   For Pounds of Tallow Neat.
                      D
   D
                                  9.04
                     19.
                                 26.74 Areas in Pounds of Tallow Neat.
                    56.5 Diam.
                               (79.84)
Gauge Pt. Unity
       The Sum of the Areas
                                115.62 which multiply by 20.7 being 1 of
                                           The Length gives the Content.
                 For Pounds of bard Soap.
   D
                                 (10.44)
                                  30.94
                                          Areas in Pounds of hard Soap.
                                (92.36)
```

133.74 which multiply by 20.7 gives the

H 2

[Content.

For

Gauge Pt. Unity

The Sum of the Areas

For Pounds of green foft Soap.

D C

19. C

19. 32.7 to \[ \frac{11.04}{32.72} \] Areas in Pounds of green fost Soap.

10. C

11.04

12.72

13.73

14. Soap.

Gauge Pt. Unity Diam.

The Sum of the Areas 141.40 which multiply by 20.7 gives the

For Pounds of white foft Soap.

D C D C

As 5.7 is to 1, so is \[
\begin{cases}
5 & 19. & 232.7 \\ 56.5 & 56.5 \end{case}
\end{case}
\text{ to } \begin{cases}
5 & 232.86 \\ 98.10 \end{case}
\end{case}
\text{ Areas in Pounds of white foft Soap.}
\end{cases}
\]

The Sum of the Areas 142.05 which multiply by 20.7 gives the [Content.

Note. The Height of the Frustum is 62 Inches, one third of which is 20.7.

Starch. For Starch by the Rule, the Work stands thus:

D C D C

As 7.2 is to 1 fo is  $\begin{cases} 19. \\ 32.7 \\ 56.5 \end{cases}$  to  $\begin{cases} 7. \\ 20.7 \\ 61.6 \end{cases}$  Areas.

Gauge Pt. Unity Diam.

The Sum of the Areas 89.3

Say again:

Starch. B A

Starch. As 1 is to 89 3 fo is

As 1 is to 89 3 fo is 20.7 to 1844.5 pounds of Starch.

To gauge an Elliptic Cone, and an Elliptic Frustum of a Cone.

To gauge an Elliptic Cone.

An Elliptic

Fruitum.

If you have an Elliptic Cone, find its Area as you did that of an Ellipsis; which multiplied by \( \frac{1}{3} \) of its Altitude gives the Content.

An Elliptic Frustum, is gauged all one as the Frustum of a circular Cone; only have regard to find the Areas, as you were taught in the Ellipsis, and 'tis done.

To gauge a Pyramid.

Of Gauging a PYRAMID.

A Pyramid being \( \frac{1}{3} \) of a Prism of the same Height and Base, and being so nearly related to a Cone, I shall omit giving an Example; and only tell you that it may have for its Base a Square, or any Regular Polygon, and terminating in a Point at the Top. Therefore find the Area of the Base (according to what Figure it represents) which multiply into \( \frac{1}{3} \) of its beight, and you have its Solidity in the same Measure the Dimensions were taken in, which you may reduce into Feet, Gallons, Bushels, Pounds, &c. as of gauging the Frustum of a Pyramid has been taught above. The Frustum of a Pyramid may be gauged

To gauge the been taught above. The Frustum of a Pyramid may be gauged ramid.

as the Frustum of a Cone, only having regard to the Area, that you find them as Squares, or Regular Polygons, and not as Circles.

## 7. To gauge a Parabolic CONOID. See Plate 2, Fig. 9.

A Parabolie

Definition. A Parabolic Conoid is a Solid, formed by the Ro- To find the tation of a Semi Parabola about its Axis. See Page 85; it is Divisors for a equal to \(\frac{1}{2}\) of its circumscribing Cylinder, having the same Base noid. and Altitude. Therefore the Divisors, &c. being doubled will be the Divisors for a parabolic Conoid.

The RULE.

Rule for gaug-

Multiply the Square of the Diameter of the Base by the height, ing a parabolic and then dividing the Product by the proper Divisors (that is by Conoid. the double of the Divisors for Circles) will give the Content.

Or:

Multiply the Square of the Base by half the Height, and divide by the proper Divisors for a Circle, will give the same Content.

Example. Let the Diameter A C be 106 Inches, and the An Example. Height BD 96 Inches, What's the Content in Feet, Ale, Wine, Malt Bushels and Tallow Pounds?

Operation. A C=106 Operation. 106 636 106 Square of A C=11236 Height A D = 96 67416 101124 4400, 316)1078656.00000(245.13 Feet Feet. 718.1)1078656.000(1502.09 Ale Gallons Ale. 588.236)1078656.00000(1833.71 Wine Gallons Wine. 5476.)1078656.00(196.97 Malt Bufbels Malt. 77.1)1078656.000(13990.35 Tallow pounds gross Tallow gross. 79.96)1078656.000(13489.9 pounds Tallow Neat Tallow neat. 79.12)1078656.000(13633.1 pounds hard Soap Hard Soap. 65.36)1078656.000(16503.3 pounds of Green foft Soap Green foft H 3 65.08 65.08)107865.6000(1657.43 pounds of white fost Soap

If you would have Gauge Points and Factors to the Parabolic Conoids, see Page 46, 48.

By the Sliding Rule on the Lines C and D.

Set the Gauge Points on D, to half the Height on C, and a-gainst the Diameter A C on D is the Content on C.

Operations.

D	C	D	C
(46.9)	(48)	(106)	C 245.13 Feet
18.94	)48/	106	1502.09 Ale Gallons
<b>17.14</b>	<b>48</b>	3106>	1833.71 Wine Gallons
52.32	48	106	196.97 Malt Bushels
As 6.2	is to 48 ) 6	is 106 )	13990.35 pounds of Tallow Grofs
(0.3)	(48)	(106)	13489.9 pounds of Tallow near
5.00	)4°C	2106	13633.1 pounds of hard Soap
5.72	7486	7106	16574.3 pounds of white foft Soap
( 3%)	(48)	(106)	10404. I pounds of green Starch
Gauge Pt.	1 Height	Diam.	Content

## 8. To gauge an Hyperbolic Conoid.

See Plate 2. Fig. 10.

Definition. An Hyperbolic Conoid, is a Solid formed by the Rotation of a Semi-Hyperbola about its Axis; it is less than the Parabola, and the Proportion to the Cylinder is as 5 to 12, or as 1 to 2.4.

Therefore the Divisors are found thus, on the Lines A and B.

## 1. For Feet by the Sliding Rule.

	В	A	
For Feet ——————————————————————————————————	2200.158 359.05 294.118 2738. 38.55 39.98 34.56 32.65 32.54 31.588	5280.3792 861.72 705.8832 6571.2 . 92.52 95.952 82.944 78.432 78.096 124.4112	•
to res Breingement	C 3300).	C	T

If you would work by Multiplication when you Gauge a Hyperbolic Conoid, you may find Factors or Multipliers, as has been taught in Page 48, and Gauge Points as on Page 46, fo that Factors and Gauge Points for an Hyperbolic Conoid stand thus:

	Factors. Ga	auge Points.	Factors and
I Feet -	.0000189381	72.66	Gauge Points.
2 Ale Gallons -	.00116046	29.35	
3 Wine Gallons -	.00141668	26.56	
4 Malt Bushels -	.00015218	81.06	
5 Tallew Pounds grofs	.01080847	9.62	
6 Tallow Pounds neat	.010421773	9.79	
7 Hard Soap	.012056327	9.107	
8 Green soft Soap -	.012749898	8.85	
9 White Soft Soap -	.012804753	8.83	
10 Green or Raw Starch	.008037861	11.15	

### The RULE.

Multiply the Square of the Diameter A C by the Height BD, Gauging an Hyand divide that Product by the Divisors above.

Or:

Multiply by the Factors above: And either of these give the Another Rule.

Example. Let A C be 113, and B D 83 Inches; What's Au Example. the Content in Feet, Ale, Wine, Malt, &c. as below.

Operation.	Operation
A C=113	
113	
339	
Square of A C = 12769 B D = 83	
38307	
102152	
52803.792)1059827 000000(200.71 Feet	Feet.
861.72)1059827.00000(1229.897 Ale Gallons	Ale.
705.8832)1059827.000000(1501.42 Wine Gallons	Wine.
6571.2)1059827.000 (161.28 Malt Buffels	Malt.
92.52)1059827.0000(11455.03 Pounds Tallow gross	Tallow.
H 4 95.952	

$-C \cap A$	

# How to Gauge Solids.

Part I.

Tallow neat.

95.952)1059827.00000(11045.38 Tallow Pounds neat

Hard Soap.

8294.4)1059827.00000(12777.62 pounds of Hard Soap

Green foft Soap. 78.432)1059827.0000(13512.68 pounds of green foft Soap

White foft Soap.

78.096)1059827.00000(13570.82 pounds of white fost Soap

Starch.

124.4112)1059827.000000(8520.35 pounds of green Starch.

By the Sliding

By the Sliding Rule on the Lines C and D.

Of the Parabolic Spindle.

9. To gauge a Parabolic Spindle.

Plate 2, Fig. 11.

Definition.

Definition. A Parabolic Spindle is a folid Body made by Rotation of a Semi-Parabola about its Ordinate, which is equal to 18 of its circumscribing Cylinder: Or, As 1 to 1.875.

#### For:

As 8 is to 15 fo is 1 to 1.875

Now if you multiply the circular Divisors by 1.875 the Products will be the Divisors for a parabolic Spindle.

A Table for a A TABLE of Divisors, Multiplicators and Parabolic Spin- Gauge Points, for a Parabolic Spindle.

	Divisors.	Factors.	G. Points
1 Feet	4125.29625	.000242406	64.228
2 Ale Gallons	673.21875		25.945
3 Wine Gallons .	551.47125	.0018133	23.483
4 Malt Bushels	5133.75	.0001947894	71.65
Tallow Pounds grofs	72.28125	.0138348	8.5
6 Tallow Pounds neat	74.9625	.01334	8.65
7 Pounds bard Soap	64.8	.015432	8.04
8 Pounds green foft Soap	61.21875		7.824
Pounds white foft Soap	61.0125	.01639	7.81
10 Green or Raw Starch	97.19625	.0123564	9.86

The

### The RULE.

Multiply the Square of a AC, by BD, and divide the Product by the proper Divisors:

The Rule for Gauging a Para-

Multiply by the proper Factors taken out of the Table above; bolic Spindle. either of which will give the Content required.

Example. Admit A C be 40, and B D 70 Inches, I demand the Content in Feet, Ale, Wine, Malt Bushels, and Pounds of hard Soap?

Operation.

A C=40

40

A C fquar'd = 1600

BD = 70

4125.29625)112000.00000000(27.149 Feet Feet.

673.21875)112000.00000000(166.364 Ale Gallons Ale.

551.47125)112000.0000000 (203.09 Wine Gallons Wine-

5133.75)112000.0000 (21.81 Malt Bushels Malt.

64.8)112000.000 (1723.39 Hard Soap Hard Soap.

By the Sliding Rule on the Lines C and D.

 $\begin{array}{c}
D & C \\
64.2 \\
25.9 \\
23.5 \\
71.65 \\
8.04
\end{array}$   $\begin{array}{c}
C \\
70 \\
70 \\
70 \\
70 \\
70 \\
70 \\
70
\end{array}$   $\begin{array}{c}
A_0 \\
A_0 \\
A_0 \\
A_0 \\
40 \\
40 \\
40
\end{array}$   $\begin{array}{c}
C \\
27.1 \\
166.1 \\
203.1 \\
21.8 \\
1728.4
\end{array}$ 

10. To Gauge a Globe or Sphere +.

## Plate 2. Fig. 12.

Definition. A Globe or Sphere, is a round folid Body, every A Globe what. Part of whose Surface is equally distant from a Point within it, called its Center; and it may be conceived to be formed by the Revolution of a Semi-circle round its Diameter.

It is  $\frac{2}{3}$  of the Cylinder that Circumscribes it, or as 1 to 1.5 so Is  $\frac{2}{3}$  of a Cyis the Divisor for the Cylinder to the Divisor for the Sphere.

Example.

† In Page 47 I have found the Area of Unity to be .785398 Inches, two Thirds of which .523598 is the Content of a Sphere whose Diameter is Unity or 1.

An Example.

Example, for the Divisor for a Globe, by the Single Rule of three Direct, for Feet fay,

As 1 is to 1.5 fo is 2200.158

1.5

11000790

2200158

3300.2370(57.44 the Square-Root, or Gauge-Point,

After the same Manner are the other Divisors and Gauge Points found, as you see done by the Sliding Rule below. For because the first Term is Unity, or 1, there is no more to do than to multiply the Divisor for the Cylinder by 1.5 and the Product is the Divisor for the Globe, whose Square-Root is the Gauge-point on the Sliding Rule.

By the Sliding

Thus, by the Sliding Rule on the Lines A and B.

	) A	В	Gauge Pt.
Feet — — — — — — — — — — — — — — — — — —	38.55	3300.237 538.575 441.177 4107. 57.825 59.97 51.84 48.975 48.81 77.757	Divi- fors 2 Globe 7.74 7.2 6.99 6.98

A Note.

Note. If the Diameter of a Globe be 1, then its Circumference and superficial Content are equal; viz. 3.141592. And if the Diameter be 6, then the Solidity and superficial Content are equal, viz. 113.097312.

The Rule.

The RULE.

Cube the Globe's Diameter, and divide by the proper Divifors for a Globe, which will quote the falid Content.

Or: Or

2. Multiply the Diameter by the Circumference, which gives A the fuperficial Content in fquare Inches; which multiplied by to of the Diameter, and divided by the fquare Divisor in the Table, Page 50, will exhibit the Content.

A 2d Rule.

Or:

3. Cube the Globe's Diameter, and multiply it by 11; and then divide the Product by 21; and this last Product divided by the square Divisors (as in the second way) gives the Content in the respective Measures.

A 3d Rule.

Or:

4. Lastly. If the Cube of the Globe's Diameter be multiplied by .523598 (the Solidity of a Globe whose Diameter is Unity or 1) it will produce the solid Content in square Measure.

A 4th Rule,

Example. Let the Diameter of a Globe be 90 Inches, I demand An Example, how many Cubic Feet, Ale Gallons, Wine Gallons, Malt Bushels, and Pounds of green Soap the same will hold?

Operation.

Operation.

C E = 90 = 90Square = 8100

3300.237)729000.00000(220.89 Feet as above

Feet.

538.575)729000.00000(1353.57 Ale Gallons

Ale.

441.177)729000.00000(1652.39 Wine Gallons

Wine.

4107.)729000.00 (177.50 Male Bushels.

Malt.

48.975)729000.00000(14885.14 Green foft Soap.

Green foft

By the Sliding Rule, on the Lines C and D.

By the Sliding

As the Gauge Point on D, is to the Globe's Diameter on C, fo is the Diameter on D, to the Content on C.

D C D C

57.44

23.2

As 21.0
64.1
7.0
Gauge Pt.

C D C
220.89 Feet
1353.57 Ale Gallons
1652.39 Wine Gallons
177.5 Malt Bushels
14885.14 Green soft Soap
Content

Note.

The new Gauge Points are for Ale 73.3 for Wine 66.42

A Note.

Note. When the Globe's Diameter 90 is fet to the Gauge Points 23.2 for Ale, and 21 for Wine, the other 90 on D doth fall off the Rule. Therefore you must have recourse to Page 49, where you have a Remedy in such Cases; for by the Pen the Divisor for Ale is 538.575, and if I remove the Dot one Place to the Right-hand, it will be 5385.75, and its Square Root is 73.38 the new Gauge-point, and that for Wine is 66.42.

Or .

By the Rule, by fetting 1, on C to the old Gauge-point 23.2, and 21 on D, the other, 1 on C will give 73.38, and

66.42 on D the new Gauge-points.

Properties of the Globe as to Divisors and Factors. If .523598, the fquare Inches in a Globe whose Diameter is 1, be divided by the fquare Divisors, the several Quotients will be Factors, by which if the Cube of the Diameter of any Sphere be multiplied, the Product will be the Content in the same Meafure.

Divisors. Solidity. Factors or Multipliers. 1728. ) .523598000(.000303 Feet 282. ) .523598 (.001856 Ale Gallons

231. ) .523598 (.002267 Wine Gallons

2150.4 ) .5235980 (.000243 Malt Bushels

30.28 ) .52359800 (.017291 Tallow pounds Gross.

31.4 ) .5235980 (.016675 Tallow pounds Net.

27.14 ) .52359800 (.019293 Hard Soap

25.67 ) .52359800 (.020397 Green foft Soap

25.56 ) .52359800 (.020484 White foft Soap

40.714 ) .523598000(.012884 Green or raw Starch.

An Example.

As for Example. The Diameter of the Globe is 90 Inches, its Cube is 729000, this multiplied by .000303 the Factor for Feet, the Product is 220.89 Feet the Content of the Globe as below.

By the Sliding Rule. By the Sliding Rule on the Lines D and E.

Set I upon D to the Factor upon E, and against any Diameter upon D is the Content upon E in the same Measure.

D E D E 220.89 Feet

| Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section | Social Section |

When Gaugers have met together, I have frequently A notable known it asked by some who fansied themselves more Polite Question with than the rest, What 8 upon 9 is by the Rule? That is, if the Diameter of a Veffel be 9, and Depth be 8 Inches, what is the Content? Answer 1.8 Ale Gallons. For your new Gauge Point will be 60, to which fet 8, and against 9 is 1.8. See page 49. This amongst them is thought to be a very learned and deep Question. Also, what is 9 upon 8? Answer 1.6 Ale Gallons.

## 11. To Gauge the Segment of a Globe.

The Segment of a Globe.

Plate 2. Fig. 12.

Definition. The Segment of a Sphere or Globe, is a Part of it Definition. cut off by a Plane; and therefore the Base of such a Segment must always be a Circle, and its Superficies a Part of the Surface of the Sphere, which Segment is always less than half the Sphere.

#### The RULE.

The Rule.

Firft, you must always be careful to find (or take) the true Base AB, which may be exactly done (in any Part of the Sphere ) by knowing the whole Diameter, or Axis CE, of which the Height of the Segment CD is a Part: For it is plain by the Figure (to every Geometrician) that A D = DB is a Geometrical Mean between C D and D E: Then for D B Say.

By the Sliding Rule, by the Lines C and D.

D 28 so is 62 to 41.66 the Mean. is to

As 62 is to 62 fo is 28 to 41.66 as before.

Secondly. When this is done, multiply the triple Height of the Segment D C, by the Square of half the Chord, viz. A D = DB; to this add the Cube of the versed Sine or Height DC; and this Sum divided by the Divisors for a Globe, gives the Content of the Segment.

Note. The Square of A D = DB, is always equal to the

Product of CE multiplied by D C.

A Note.

Example. Let the Diameter of a Globe be C E = 90, the An Example. Chord of the Segment A B = 83.32, the versed Sine or Height CD =28, I demand what is the Content in Feet, Ale Gallons, Wine Gallons, Malt Bushels, Pounds of Tallow Gross, Tallow Neat, hard Soap, white foft Soap, Green foft Soap, and Green Starch.

Operation.

Operation.

CD = 28	CD=28 D E=62 28 C D=28
84	224 496 56 124 784 1736 = Square of A D
	28 84 three Times CD 6272 6944
Y.	1568 13888 21952 145824 add 21952 Cube of the versed Sine or Height
Feet.	3300.237)167776.00000( 50.84 Feet
Ale.	538.575)167776.00000( 311.51 Ale Gallons
Wine.	441.177)167776.00000( 380.29 Wine Gallons
Malt.	4107. )167776.00 ( 40.85 Malt Bushels
Green foft	48.975)167776.00000(3425.79 Green soft Soap
Tallow Gross.	
Tallow neat.	59.97 )167776.0000 (2797.66 pounds of Tallow Neat
Hard Soap-	51.84 )167776.0000 (3236.42 Ferè pounds of hard Soap
White foft Soap.	48.815)167776.00000(3437.32 pounds rubite soft Soap
Starch.	77.757)167776.00000(2157.69 pounds of green Starch.

By the Sliding Rule.

By the Directions in Chap. xiii. you may divide the several Dividends, and you will find them on the Rule the fame as were found by the Pen.

Of the Frustum of a Globe-

12. To Gauge the Frustum of a Globe.

See Plate 2. Fig. 12.

Definition.

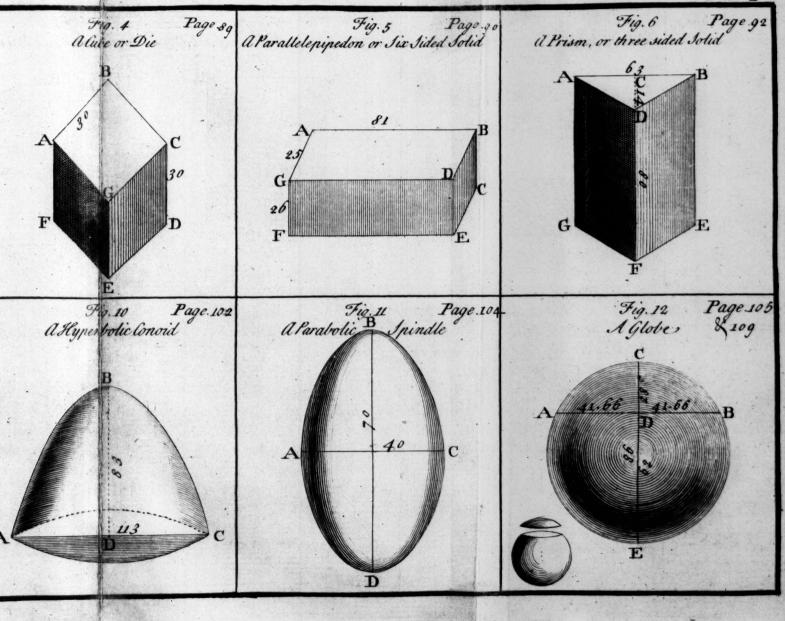
Definition. The Frustum of a Globe is a Piece cut off, or as in this Figure it is the Part A E B, and is more than half the Globe. The RULE:

The Rule.

fee in Page 109.

For this is the same as in the Segment of a Globe, which

Example.





# Chap. XXI. How to Gauge Solids.

Example. Let the Diameter of the Globe be 90, the Chord of the Segment A B = 83.32, and the Height of the Segment D E = 62 Inches, I demand how many Feet, Ale, and Wine Gallons, Malt Bushels, pounds of Tallow Gross, pounds of Tallow neat, pounds of bard Soap, pounds of white soft Soap, pounds of green starch the Frustum A E B will contain?

Operation.  $D E = 62 \qquad D E 62 \qquad 62 \qquad 3 \qquad 62 \qquad 372 \qquad 3844 \qquad 62 \qquad 7688 \qquad 23064$ Cube of D E = 238328

DE = 62 CD = 28 496 124 1736 = 9 A DTriple of DE = 186 10416 13888 1736 322896Cube of DE add 238328

3300.237)561224.00000( 170.06 Feet

538.575)561224.00000(1042.05 Ale Gallons

441.177)561224.000000(1272.106 Wine Gallons

4107.)561224.00 ( 136.65 Mals Bushels

48.975)561224.0000 (11459.4 Green fost Soap

57.825)561224.00000(9705.56 Ferè pounds of Tallow Gross

59.97)561224.0000 (9358.41 pounds of Tallow neat

51.84)561224:0000 (10826.08 Ferè pounds of hard Soap

48.81)561224.0000 (11498.14 Ferè pounds of white foft Soap

77.757)561224.00000(7217.66 pounds of green Starch

# How to Gauge Solids.

Part I.

If you add the Content of the Segment ACB, to the Content of the Frustum A E B, the Sum will be equal to the Content of the Globe of which the Segment is a Part.

Of the Spheroid13. To Gauge a Spheroid.

Definition.

See Plate 3. Fig. 1.

Definition. A Spheroid is produced by the Motion of a Semi-Ellipsis, the transverse Diameter remaining fixed, and it is equal to 3 of its circumscribing Cylinder. See the Globe on Page 106. The RULE.

The Rule.

Multiply the Square of the conjugate Diameter CD, into t-wo Thirds of the transverse Diameter A B, and divide the Product by the circular Divisors for Feet 2200.158, for Ale 359.05, for Wine 294.118, for Malt 2738, &c. See Page 50, the Quotients will be the Content.

A 2d Rule.

Or, which is better:

Multiply the Square of the conjugate Diameter, by the transverse Diameter; and that Product divided by the Divisors proper for a Spheroid (the fame of the Globe in Page 106) will give the Content.

An Example.

Example. Let the transverse Diameter A B be = 50 Inches, and the conjugate Diameter C D = 31, I demand the Content in Feet, Ale, Wine, Malt, and Pounds of raw Starch? Operation.

Operation.

CD = 3193

Square = 961 AB =50

Feet.

3300.237)48050.00000( 14.55 Feet

Alc.

538.575)48050.00000( 89.22 Ale Gallons

Wine.

441.177)48050.00000(108.91 Wine Gallons

Malt.

4107. )48050.000 ( 11.699 Malt Bushels

Starch.

77.757)48050.00000(617.95 Green or raw Starch.

By the Sliding

By the Sliding Rule. D C31 14.55 Feet 57.44 89.2 Ale Gallons 108.9 Wine Gallons 11.7 Malt Bushels 617.9 Raw Starch Gauge Pt. Content Diam. Diam

To what goeth before I shall add the Proportions of Solids in the Cube and Cylinder, having the same Base and Altitude. 1. A Cube

ough man en ounge when	Cremery.	113
1. A Cube, whose Side is 12 Inches, the folid	1728	A Cube,
2. A Triangular Prism, having its Base and Altitude equal, viz. 12 Inches, its Solidity is	748.24	A Triangular Prifm.
3. A Square Pyramid, having its Height and Base equal to the Base of the Cube 12, is \( \frac{1}{3} \) of its Content	576.	A Square Pyramid
4. A Triangular Pyramid, whose Height and Base is 12 Inches, is near \(\frac{1}{7}\) of it, its Content is	249.4152	A Triangular Pyramid:
5. A Cylinder, whose Diameter and Height is 12 Inches, equal to the Side of the Cube, is $\frac{1}{14}$ of it, and its Solidity is	1357-17	A Cylinder.
6. A Sphere or Globe, whose Axis is 12 Inches, equal to the Side of the Cube is 11 of it, its solid Content is	904.78	A Sphere.
7. A Cone, whose Diameter of its Base is 12, equal to the Side of the Cube is $\frac{5}{12}$ of it, and its solid Content is just $\frac{1}{3}$ of the Cylinder above—	452.38829	A Cone
8. A Parabolic Conoid, whose Diameter at the Base is 12 Inches, equal to its Height is half its Circumscribing Cylinder, and its solid Content is		A Parabolic
9. A Hyperbolic Conoid, whose Height and Dia- meter at the Base is 12 Inches, is $\frac{5}{12}$ of its Ctrcumscribing Cylinder; therefore its solid Content is	565.49	A Hyperbolic Conoid.
10. A Parabolic Spindle is $\frac{8}{5}$ of its Circum- feribing Cylinder; and therefore its Con- tent is		A Parabolic Spindle.
11. A Spheroid is $\frac{2}{3}$ of its Circumscribing Cylinder; and consequently its Content is—		A Spheroid,

## CHAP. XXII.

Shewing bow to gauge all Sorts of Open Vessels.

1. Of Vessels, as Tuns, Backs, Coolers, Coppers, &c.



AS H-TUNS and Guile-Tuns, are generally the Of Mash-Tuns Frustums of a Cone, and it matters not whether and Guile Tuns, they stand upon the lesser or greater Base, for the Method of Gauging them is all one.

See Plate 4. Fig. 2.

# Co Sauge Dpen Meffels. Part I.

The Rule.

The RULE.

With your Sliding Cane, take the Diameter in the Middle of every 10 Inches from the Bottom upwards, and enter them with their Areas in Ale Gallons in your Dimension-Book, and also in your Stock-Book, which will be a Table for that Tun.

Or.

The Diameter may be found in any Part thereof by knowing the Depth, and the top and bottom Diameters, by this

RULE.

Divide the Difference between the top and bottom Diameters by the Depth of the Tun, and the Quotient is a common Multiplier, by which multiply any Depth, and add the Product to the bottom Diameter, (if the Tun stand on the lesser Base) or subtract it from the bottom Diameter (if the Tun stand upon the greater Base) and the Sum or Difference is the true Diameter at the Depth then taken.

An Example.

The Rule

Example. Let the Depth E F be 60, the top Diameter A B =48, and the bottom C D=40 Inches; I demand the Diameter of the Middle of every 10 Inches from the Bottom upwards, and also how many Ale Gallons the Tun will hold?

Operation.

Operation.

 $\begin{array}{c}
AB = 48 \\
DC = 40
\end{array}$ 

60) 8. (.1333 the common Multiplier.
The Depth 5

.6665 + 40 = 40.7 the Diameter at 5 Inches deep. And therefore .1333×15=2.+40=42 the Diameter at 15 Inches deep. Again, .1333 × 25 = 3.3 + 40 = 43.3 the Diameter at 25 Inches deep. And, .1333 × 35 = 4.7 + 40 = 44.7 the Diameter at 35 Inches deep: and by proceeding thus I have the Diameter in the Middle of every 10 Inches from the Bottom upwards, viz. at 45 Inches deep the Diameter is 46, and at 55 it is 47.3 as you see in the Figure. Now, by the Rule find Areas (as I have taught in Page 33.) in Ale Gallons, and they will stand thus:

Diam.	Area.	Content.
47.3	6.23	62.3
46.	5.89	58.9
44.7	5.56	55.6
43.3	5.22	52.2
42.	4.91	49.1
40.7	4.61	46.1

The Sum is the Content of the Tun 324.2 Ale Gallons. By

By removing the Dot one Place to the Right Hand every Area is multiplied by 10, which added together gives the Content of the Tun in Ale Gallons, as you see done in the last Page on the Right-Hand: but when the Depth of the Tun is not even 10 Inches (but this is) then you must add together as many Areas as are taken in the Middle of every 10 Inches; and the other Part of the Depth, which is not even 10 Inches, as suppose 4, 5, 6, or 8, &c. must be multiplied by the uppermost Area, which Product added to the Sum of the other Area's, gives the Content: And this is the practical Way of casting up Gauges by those employed in the Excise.

But to find what the Tun will hold upon every Inch, (which How to inch is called Inching the Tun) as is requifite in larger Tuns used Tun. by common Brewers; proceed thus: The Content of the Tun, as it stands upon Area's in the Middle of every ten Inches, is 324.2 Gallons, which reduced into Barrels of 34 Gallons,

B. F. G.

each are 9 2 1.2, which enter as you see in this Table; whose Numbers fignify Barrels, Firkins, and Gallons.

1. Then take the first Area 6.23, and Disar. Fir. Gal. First Area fubtract it from 9 2 1.2 as you are di-1.2 rected in Pager 4. 3.47 Then there will remain 9 1 3.47, 0 5.74 and thus continue subtracting 6.23 'till 3 8.01 the Tun be 10 Inches dry, when the Con-1.78 8 B. F. G. 4.05 tent will be 7 6.90 6.32 2 0.09 Second Area 2. Take the second Area 5.89 Gallons, 1 2.36 0 dry, and fubtract it 'till the Tun is 20 Inches 4.63 B. F. G. when the Remainder will be 5 7.80.

3. Take the third Area 5.56, which fubtract as before, Third Area 'till the Tun is 30 Inches dry; and the Remainder will then

B. F. G.

be 4 1 3.2.
4. Take the fourth Area 5.22, and subtract it as before, Fourth Area, 'till the Tun is 40 Inches dry; and the Remainder will be B. F. G.

5. Take the fifth Area 4.91, and subtract it as before, 'till the Fifth Area,
B. F. G.

Tun is 50 Inches dry; and the Remainder will be 1 1 3.9.

6. Take the fixth Area 4.61, and fubtract it as before, Sixth Area. 'till the Tun is 60 Inches dry; and then there will remain nothing.

By this Way of Inching you will have the Content of the A more exact Tun at every Inch from the Top; but if you would be more Method. exact, take an Area at every Inch deep, and that will be perfectly true; for the Sum of them will be the true Content.

2. To find the Drip or Fall of a Tun. Of the Drip of a Tun. See Plate 4. Fig. 9.

Definition.

Definition. The Drip or Fall of a Tun, is when it is fet a little sloping on one Side, for Conveniency of Cleanfing; fo that when the Bottom is just covered at D, the other Side E C is 15.57 Inches; draw the Line E F parallel to the Bottom CD; and then 'tis plain, that when the Tun stands in this Oblique Position, that the Quantity of Wort, &c. = CDE, is but just half of CDFE; because DFE=CDE. Euclid 4. 6.

Sides of Equilateequal.

Now, if we find the Content of the Frustum CDFE, the ral Triangles are half of which will be the Quantity of Liquor that will just cover the Bottom at D: Or, if we find the Content of the Frustum A BH G, the balf of which, viz. A BG subtra&ed from the Tun's Content, will leave the Quantity of Liquor that will just fill up the Tun to B: So that the Liquor's Surface shall be represented by the Line G B.

To find the flant Height of any open Tun, this is The flant Height.

The Rule.

#### The RULE.

To find the flant Side of a Tun.

To the Square of the Depth, add the Square of half the Difference of the two Diameters, and the Square Root of that Sum is the flant Height. By which I find AD=BC=60.13, and EC=15.57 Inches.

And as it is shewn in Page 114, I find the Diameter GH

to be 45.5, and FE 42.1.

Note, If the Vessel is empty, and you would find the Point G, that is, where the Surface of the Liquor would cut, if it were fill'd up to B; it may be done by the Help of a Quadrant, such as I have described in my Mechanick Dialling, Page 11; for looking thro' the Sight at B, and the Thread falling at the Beginning of the first Degree in the Limb, your Sight will then be directed to the Point G, where you may make a Mark with Chalk : Measure the Distance A G with your Gauging Cane, which I suppose to be 17.5; then find AL, and it will always hold:

Now, to find what the Part ABGA will hold, this is

The Rule.

#### The RULE.

To the Square of the top Diameter A B 48, add one half of the Rectangle, or Product of the top and bottom Diameters; multiply the Sum by the Depth A L, and divide the Product by 1077.15 for Ale, and by 882.354 for Wine.

See

See the Work.

Operation.

ABq = 2304.  $AB48 \times GH45.5 = 2184 + 2304 =$  $3396 \times AL = 17.46 = 58294.16$ 

1077.15 = 54:12 Ale Gallons.

Subtract the Part ABGA = 54.12 A. G.

ls

e

Remains GBCDG = 270.08

Laftly, To know how much Liquor will cover the Bottom at D; by the Rule in Page 97. find the Frustum FECD, the Half of which is the Portion C D E C.

Operation.

Operation.

$$FE = 42.1 FE - DC = 2.1 q = 4.41$$

$$DC = 40$$

$$1684.0$$

The Square of their Diff. +4.41

The Sum = 5056.41 The Depth = 15.5 2528205 2528205 505641

> 1077.15)78374.3550 (72.76 = FECD. 36.38 = CDEC.

3. To gauge a Mash-Tun. See Plate 4. Fig. 2.

To gauge Mash-

Definition. Mash Tuns are generally Frustums of Coues, Definition. flanding fometimes on the greater, and fometimes on the leffer Base; and therefore the Diameters are taken with your sliding Rule, (if 'tis long enough.) By pinning one End thereof fast, and drawing out the other Slider, it will shew you the Diameter in Inches and Decimal Parts, if less than 36 Inches: But if your Tun be larger than 36 Inches, you must use your sliding Cane, and take the Diameters in the middle of every 10 Inches from the Bottom upwards, which will be exact

I have known many Country People to use one and the same Tun, both for Mashing and also for Working their Ale; for which Reason I shall make use of Fig. 2. Plate 4.

### To Sauge Dpen Meffels.

enough for this purpose, and insert them in your Dimension-Book: But before the Areas can be fix'd, the Diameter fo taken must be had in Gallons, Corn Measure; and because 2150.4 Square Inches are contain'd in one Bushel, and 2738 is a Divisor for a circular Bushel; and because 8 Gallons make 1 Bushel; take 1/8 of 2150.4, which is 268.8, its Square Root is 16. 4 fere, which is a Gauge Point for Square Mash Tuns; also is of 2738 is 342.25, its square Root is 18.5, which is a Gauge Point for round Mash Tuns.

Observation.

But it being found by Experience, that after two or three feveral Sorts of Worts have pass'd through the Malt, it is more compact by an eighth Part; therefore take 1 Part of 268.8, and it is 33.6, which fubtract from 268.8, and it leaves 235 . 2, whose square Root is 15 . 3, which is a Gauge Point for square Mash Tuns. Also \$ of 342 . 25 is 42 . 78, which taken from 342.25 leaves 299.47, and its square Root is 17.3 the Gauge Point for circular Mash Tuns. By the Work above I have found,

So that if you square the Diameters, and divide by 299.47, the Quotient will be the Area in Gallons; which divided by 8 give Bushels of Malt brewed.

An Example.

Example. Let the Diameter of the Tun above-mention'd be, as is there express'd, how many Bushels of Malt (Goods) doth it contain?

By the fliding

Operation by the Sliding Rule.

A Note.

Note, In adding of these Area's, the Dot is removed one Place to the Right Hand, and that multiplies by 10.

4. To gauge a Back or Cooler.

Of Backs.

See Plate 4. Fig. 8.

Definition. A Back, or Cooler, is fquare or oblong, made Definition, of Wood, &c. about 6, 8, or 10 Inches deep, into which the boiling Wort is let out of the Copper, for more Expedition in cooling: Common Brewers have under Backs, that is one under another.

Most Backs have their Sides straight; and in Case the Sides be not straight, but make either an obtuse, or acute Angle with the Bottom, you must then be careful to take the true Length and Breadth in the Middle of every Inch in Depth, from whence the Area may be found upon every Tenth.

For finding the Area of the Back observe

#### The RULE.

The Rule.

Multiply the Length by the Breadth, and divide by 282, this gives the Contents in Ale Gallons.

Example. Let the Length A B be 120, and B C 86 Inches; An Example. What's the Area in Ale Gallons?

Operation.

A B=120 B C= 86

720

282)10320.00(36.59 Ale Gallons.

By the Sliding Rule.

By the fliding

A. B. A. B.

As 282 is to 120, so is 86 to 36.6 the Area in Ale Gallons.

Divisor. Length. Breadth.

IA

Take

<sup>\*</sup> I would advise every Supervisor and Officer, when they first come into a new District or Division, to try an Experiment of several of their Victuallers, by Gauging of the Malt before 'tis wet, and also by Gauging the Goods when brew'd; by this 'tis probable they may come nearer the Truth, than by always keeping to the Divisors and Gauge-Points above prescribed. For I have Reason to think, that different Malt, different Water, and Peoples different Management, will make some Alteration in the Rule above given.

### Co Sauge Dpen Ceffels. Part I.

Take one tenth of the Area, and reduce it into Barrels, Fir-B. F. G.

kins, &c. = 0 0 3.659, which add c	ontinual	lly,	giv	es what
the Back holds upon every Tenth of the first Inch deep; as in this Table; where	10	Ba	Fin	. Gall.
the Area answering one Inch deep is		0	0	3.659
B. F. G.				7.318
1 0 2.59 = to 36.59 as found above;	.3	0	1	2.477
and thus you may proceed for the next	•4	0	1	6.136
Inch deep, and so on for the whole	-5	0	2	1.295
Depth = A E.9.5 Inches, which mul-	6	.0	2	4.954
tiplied by the Area 36.59, produceth				0.113
247.605 Ale Gallons the subole Content		0	3	3.772

Note. The whole Content may be found by the Siding Rule, as in page 92.

Of the Dip of Backs.

A Note.

### 5. To find the true Dip of the Backs.

Because Backs are not placed level but sloping, for Conveniency of drawing off the Wort; therefore if you should dip in too deep a Place, you would wrong the Subject, and if in too Shallow a Place you would wrong the King; to remedy which, take as many Dips as you think convenient, and add them

all together, and divide them by the Number of Depths. Dips, which will give a mean Dopth; when this is done, you must make Trial in many Places of the Back, 'till you find a Dip that answers your mean Depth; as suppose at D, right against it on the fide of the Back make a Mark, or Notch, with a Knife, and let that be your constant true

of the Back if it were placed parallel

to the Horizon.

dipping Place. An Example,

Example. Suppose I take as many Dips as per the Figure on Plate 4. Fig. 8. and add them together, they will stand as in the Margin. The Sum of these ten Dips is 29.5, which divided by 10 quates 2.95 for a mean true Depth.

2.9. 10)29.5(2.95

3.1

3.4

2.8

3.2

3.3

3.0

2.6

2.5

Of Coppers with Rifing Crowns.

6. To gauge a Copper with a Rising Crown.

See Plate 4. Fig. 6.

Definition: In London the common Brewers Coppers are all made with Rifing Crowns, which they tell you are made fo, that the Liquor and Wort may boil the fooner.

How

How to take the Dimensions.

How to take the

- 1. Try if the Copper be perfectly round; then let two Af-Dimensions. fistants hold a Packthread right over the middle from A to C, and take the Diameter AC, which I suppose to be 61 Inches.
- 2. Hang one Plumb Line at m, and another at n, take the Depths m F and n G each = 51 Inches.
- 3. Take the Distance A m = n C = 10.25, whose Sum 20.5 taken from A C = 61, there rests F G = 40.5 the Diameter of the Crown.
- 4. Now to find the Content of the Copper from the Crown To find the Conupwards, viz. the Part ACDE, the Depth BH being 39 tent. Inches, find a Diameter in the middle of every 4 Inches, (for the more the better where the Copper is large,) and place them with their Area's, as in the following

TABLE.

A Table.

Parts of the Depth,	Diame ters.	Area Ale Gállons		4 Inc	of every hes, G.
3	61.5	10.53	0	3	6.09
4	62.5	10.88	1	1	1.02
4	62.0	10.71	I	1	0.34
4	61.5	10.53	1	0	8.12
4	60.5	10.19	1	. 0	6.76
4	59.5	9.86	I	0	5.44
4	58.5	9.53	1	0	4.12
4	56.5	8.89	1	0	1.56
4	54.5	8.27	0	3	7.58
4	52.5	7.68	0	3	5.22
39		Sum	11	0	3.75
To co	ver the	Crown	I	0	2.90
Content	of the	Copper	12	0	6.65

Finft. Place the Parts of the Depth; next, the Diameters in the middle of every 4 Inches; then the Area's of those Diameters; and lastly, the Contents of every 4 Inches, reduced to Barrels, Firkins, and Gallons.

5. Multiply every Area by the Depth 4, and reduce the Product into Barrels, Firkins, and Gallons; only the top mean Area is taken in the middle of 3 Inches; therefore its multiplied by 3, and its Product reduced as before.

6. To find the Quantity of Liquor that will cover the What Liquor will Crown, that is the Part FEHDGH. cover the Crown.

### To Sauge Dpen Meffels. Part I.

First find what the Frustum F E D G will hold; and also of the Crown F H D G I, it being gauged as the Segment of a Globe, in page 109, which Content being subtracted from the Frustum F E H D G, will leave the Part F E H D G H, that is, what will cover the Crown.

Operation for the Frustum.

See page 86, 87.

See the Work.

1. For the Frustum FEHDGF.

ED = 49.25 FG = 40.5	ED = 49.25 FG = 40.5
24625	Differ. $= \frac{8.75}{8.75}$
1994.625	4375 6125 7000
5983.875 add 76.5625	76.5625
6060.4375	

1077.15)72725.25000 (67.525 Ale Gallons.

See page 95.

Operation for the Segment of the Globe. 2. For the Segment of the Globe FHGI.

	Operati	on.
HI=12 H	I I=12	IG 20.25
3	12	20.25
Triple of H I=36	144	10125
	12	4050
		4050
Gube of HI =	= 1728	410.0625
AC STALL BY MANY SALE		24603750 12301875
Cube of	HI add	14762.2500

538.575) 16490.25000(30.618 A.G.

From FEHDGIF = 67.525 Subtract FHI = 30.618

Remains FE H D G H=36.907 which will cover the Crown?

The Copper may be Inched by the same Method as Inching the Tun in Page 115.

Note. The Quantity of Liquor that will cover the Crown Another Way, may be found by this

#### RULE.

From the Area of the Plane at the Top of the Crown, Ward's Mathem, fubtract 1 \frac{1}{3} of the Area of the Crown's Height, the Remain-page 443. der being multiplied into Half the Height of the Crown, will produce the Quantity or Number of Gallons that will cover the Crown.

So E D = 49.25 Area 6.75, and the Area of H I 12 = .4011, I  $\frac{1}{3}$  of which is .5348, fubtract from 6.75 refts 6.2152  $\times$  6, that is  $\frac{1}{2}$  of H I = 37.2912 differing only .384 Parts of a Gallon from what is found above.

### 7. To gauge a Still. See Plate 4. Fig. 7.

Of a Still.

Definition. Stills are generally made with rifing Crowns, Definition, as the Coppers are, and must be divided into such Figures as (according to your Judgment) you think they make the nearest Approaches to. So in the Still before us; the Part A L B must be gauged as the Segment of a Globe; the middle Part E ABF, as the middle Frustum of a Spheroid; and the lower Part (as in the Copper) G E F H as a Parabolic Conoid.

#### EXAMPLE.

An Example.

Let AB = 30. EF = 30. AG = 35. LM = 7 M I = 29.5 I K = 5.5 GH = 23. CD = 39.

How many Wine Gallons will the Still hold?

1. For the middle Frustum E ABF, as the middle Frustum For middle of a Spheroid.

#### The RULE.

The Rule.

To twice the Square of CD, add once the Square of AB, multiply the Sum by MI, and divide the Product by 882.354 (that is three times 294.118) and the Quotient is the Content of that Part in Wine Gallons.

### To Sauge Dpen Meffels. Part I.

Operation.

882.354)116289.00000(131.79 Wine Gallons.

2. For ALBM, as the Segment of a Globe.

Operation for the Segment of a Globe.

11/1/ 5 C

Operation.

L M = 7 L M = 7 Half A B = 
$$\frac{15}{15}$$
 $\frac{7}{49}$ 
 $\frac{7}{21}$ 

The Cube 343

The Cube L M add =  $\frac{4725}{343}$ 

W.G.

See the Rule at 3. For the Part EIFHIG, viz. what will, cover the Bottom of Page Crown.

See the Work.

Operation for the Crown.

EF = 30 Area Wine Gallons 3.05 IK 5.5 Area = . 102 and 1 = - .137 Remains 2.913 Half of IK = 2.75

> 14565 20391 5826

will cover the Crown EIFHIG = 8.01075 Add { E C A B D F = 131.79 A L B M = 11.48

The Content of the Still = 151.28075 Wine Gallons.

Note, When the Still is large, that the Sliding-Rule will A Note. not reach the Diameters, then you must take them with your Sliding Cane; and the exactest Way is to take a Diameter at every Inch of the Depth in Wine Gallons, which added together give the true Content of the Still.

### CHAP. XXIII.

Of CASK GAUGING.

See Plate 4. Fig. 3, 4, 5.

HIS is the most abstruse Part of Gauging, be- Of Cask Gauging, cause no one certain or general Rule can be prefcribed to find the true Content of all Sorts of Casks; and therefore Gaugers do usually sup: pose every Cask to be in the Form of some one of these following Solids,

1. The middle Frustum of a Spheroid.

2. The middle Frustum of a Parabolic Spindle.

The lower Frustums of two = Parabolic Conoids.
 The lower Frustums of two = Hyperbolic Conoids.

5. The lower Frustums of two = Cones.

20

1. Now, to have a true Notion of these several Casks, view First Variety. Plate 4. Fig. 3. and Plate 5. in which the outmost Lines, which represent the Staves, are very much Curved or Arching. This represents a Cask of the first Variety, and is, what

is called, the middle Frustum of a Spheroid, and consequently will hold more than a Cask of any other Form.

Second Variety.

2. The next curved Line within that I have been speaking of, represents a Cask of the second Variety; and its Content will be less than that of the Spheroid: This is called the middle Frustum of a Parabolic Spindle.

Third Variety.

3. The lower Frustum of two equal Parabolic Conoids is the next curved Line; and holds less than the second Variety, as is easy to conceive. This is called a Cask of the third Variety.

Fourth Variety.

4. The fourth Variety, which is the lower Frustum of two Hyperbolic Conoids. The Staves of such a Cask are more straight, and consequently holds less than any of the other three before mentioned. This is not represented in the Pigure, because it would be too much crouded; but will be found in Plate 5.

Fifth Variety.

5. A Cask in the Form of two equal Cones, abutting on one common Base, is represented in the Figure by the innermost Line, which is perfectly straight from Head to Bung; that is from A to B, or from B to I. This Cask of all others holds the least.

Three Varieties on the sliding Rule,

The first, second, and third Variation of Casks are put upon one Edge of the Sliding-Rule (See Plate A, fig. 4.) Their Use will be more fully shewn by and by in their proper Places.

And now if you consult Plate 3. you will have the Form of every particular Cask, represented in a Figure by it self.

Of the Spheroid.

1. In the Spheroid (Fig. 1. Plate 3.) if it be cut by a Plain Parallel to CD as TV, through the middle of IB, the Content of the Frustum TBV, to the Content of a Cylinder, whose Base is TV, and Altitude WB, is as 5 to 9? therefore the Area of the Base TV, multiplied by sive Ninths of WB, gives the Content of the Frustum TBV.

Wallis's Algebra, Page 312.

TCEAFDV, is equal to a Cylinder, whose Base is TV, and its Altitude WA; therefore the Area of the Base TV, multiplied by the Altitude WA, gives the Content of the Frustum TCEAFDV.

To describe the Spheroid.

3. To describe a Spheroid, Plate 3. Fig. 1. the middle Frustum of which shall represent a Cask of the sirst Variety, whose Bung-Diameter CD, is 31 Inches, the Diameters at the Head EF and GH, are each 24 Inches, and the Length RS 32.5 to find the Content in Ale and Wine Gallons.

From the Square of CD, the Bung-Diameter, fubtract the Square EF, the Head-Diameter. Then,

As that Difference, = 385
Is to the Square of CD, 961
So is the Square of IR, 264.0625
To the Square of IA, 659.1274. The Square
Root of which is 25.67, the Semi-Axis of the Spheroid.

- 1. With which, as a Radius, describe the Circle K A L B.
- z. Draw the Line K L.
- 3. And from the Point I, set off half the Conjugate Diameter 15.5 to C and D.
  - 4. Also set half RS = 16.25 from I to R and S.
- 5. Draw Lines through R and S, parallel to CD, viz. MN and GH.
- 6. Draw O Q parallel to CD; join IO and IM; I \* fay, IM fquared IRq = MRq. And as IK is to IC; fo is MR to ER; this will hold wherever R be taken, and give the Points PE as many as you please.

### An Illustration by Numbers.

IK IC MR ER

Illustration by Numbers

As 25.67 is to 15.5 so is 19 to 11.47; this ER falling so near the Head Diameter, I make ER to serve for this Line, as well as for the Head Diameter, which I make 24. And KI = MI = AI 25.67, doubled gives AB the whole Axis of the Spheroid. And if from AI 25.67 you fubtrate IR 16.25 half the Cask's Length, there remains AR = SB 9.42.

Now, to find the Content of the Spheroid GCEFDH How to gauge this is

#### The RULE.

The Rule.

1. To the Sum and Half Sum of the Squares of the Bung and Head-Diameters, add Half the Difference of the said Squares; the Sum of these multiplied by the Length, and the Product divided by 1077.15 for Ale, and by 882.354 for Wine, gives the Content respectively.

Exam-

By the 47th Proposition of the First Book of Euclid's Elements it is proved in the Triangle MRI, that the Square of IM, is equal to the Square of IR, and RM, by which MR is easily found to be 19. ferè.

An Example.

Example. Let the Dimensions be as above, I demand the Content in Ale and Wine Gallons ?

Operation.

Operat	ion.
CD 31	E F 24
31 93	96 48
The Square of C D 961 Square of E F 576	Square of EF 576
The Sum 1537 The Half Sum 768.5 Diff. of the Squares 192.5	
he Sum of all Three 2408	

1 Diff. of the Sq The Sum of all Three 2498. The Cask's Length 32.5

12490 4996 7494

1077.15)81185.0000 (75.37 Ale Gallons.

882.354) 81185.00000 (92.01 Wine Gallons.

2. To twice the Square of the Bung Diameter add once the Square of the Head-Diameter, multiply the Sum by the Length of the Cash within, and divide the Product as before for Ale and Wine Gallons.

Example. Let the Dimensions be as above, I demand the Content in Ale and Wine Gallons?

Operation by	Rule	2.
--------------	------	----

The Operation.

· CD:	=31	E	F = 24
	31		24
			-
	31		96
	93		48
- '-			
The Square	961		576
	. 2		

Twice the Square 1922 EF squared = 576 The Sum 2498 The Length = RS

12490 4996 7494

1077.15)81185.0000(75.37 Ale Gallons.

882.354)81185.00000(92.01 Wine Gallons.

Wine.

By the Sliding Rule.

By the fliding

Multiply the Difference between Head and Bung always by Rule. .7 (or more correct by .697 to make it agree with the fliding Rule,) and that Product added to the Head Diameter is a mean Diameter, which reduceth the Cask into a Cylinder; so the Difference between Head and Bung is 7 × .7 = 4.9 + 24 = 28.9 the mean Diameter.

Or.

Look upon one Edge of the sliding Rule for 7. the Difference, and right under it you will find 4.9 nearly, to be added to the Head Diameter, then on the Line C and D.

As 18.94 is to 32.5 fo is 28.9 to 75.37 Ale Gallons. As 17.14 is to 32.5 So is 28.9 to 92.01 Wine Gallons.

2. To gauge the middle Frustum of a Parabolic Spindle.

See Plate 3. Fig. 2.

1. To describe a Parabolic Spindle in Plano, the middle Frustum whereof shall represent a Cask, whose Diameter at

Ale.

Wine,

Of the middle Frustum of a Pag

rabolic Spindle,

Part I.

the Bung CD = 31 Inches; the Diameters at the Heads NP and QR are each = 24 Inches, and the Length 32.5 Inches.

How laid down.

It is laid down by this Proportion.

As E B fquared, is to E F fquared, fo is E C to nm; then Fm-nm = Fn, and fo of all the relt, through which Points thus found, draw the Curve, and it's done.

In Page 85. I have told you that a Parabolic Spindle is 3 of its circumferibing Cylinder; then to gauge its middle Frustum

NCQRDP, this is

Rule.

The RIILE.

To double the Square of the Bung-Diameter, add the Square of the Head Diameter; from this Sum take four tenths of the Square of the Difference between the Head and Bung Diameters; multiply the Remainder by the Length of the Cask within, and divide the Product by 1077.15 for Ale, and by 882.354 for Wine Gallons.

Example,

Example. Let the Dimensions be as above; I demand the Content in Ale and Wine Gallons?

The Operation,

Operation.

The Sum 2498

The Length = 
$$OH = {}^{2478.4}_{32.5}$$

$$123920$$

$$49568$$

$$74352$$

1077.15)80548.0000(74.78 ferè AleGallons.

Ale

882.345)80548.00000(91.28 Wine Gallons.

Wine

By

I

Ca

By the Sliding Rule.

By the Sliding

The Difference between Head and Bung of this Cask must be multiply'd by .68, its Product added to the Head Diameter gives a mean Diameter, which reduceth the Cask into a Cylinder:

On the Sliding Rule look for the Difference of the Head and Bung Diameters, and against it in the second Variety is the Number to be added to the Head Diameter, as before. Therefore  $31 - 24 = 7 \times .68 + 24 = 28.76$ . now on the Lines C and D.

As 18.94 is to 32.5, fo is 28.76 to 74.78 Ale Gallons.

As 17.14 is to 32.5, so is 28.76 to 91.28 Wine Gallons. Mean. Content. G.P. Length.

3. To gauge the lower Frustum of two Para- of the lower bolic Conoids.

Frustum of two Parabolic Conoids,

See Plate 3. Fig. 3.

This will be the best explain'd by delineating the Figure.

How to delineate a Parabolic Conoid.

How to delineate

Let GH the Bung Diameter be = 31, IK=EF=24, it. and BD the Length 32.5. What's the Content in Ale and Wine?

From the Square of G C, subtract the Square of E D, then fay,

> As that Difference, Is to CB, the Altitude of the Frustum, So is the Square of G C, To CA, the Axis of the whole Conoid.

That is, as G C squared, is to E D squared, so is G C to CA

Now if from CA, you fubtratt CB, there will remain. BA, the Altitude of the Parabolic Conoid.

And fince every Parabolic Conoid is equal to half a Cylinder of the same Base and Altitude IN q K; the Area of the Base GCH multiplied by balf the Altitude CA, gives the Content of the Parabolic Conoid. And the Area of the Base IBK, multiply'd by half the Altitude BA, gives the Content; therefore, if from the Content of GIAKH, you subtract the Content of I A K, there will remain the Content of the Frustum GIKH.

Now A C standing at right Angles to the Base GH, is called the Abscissa, and bk, ch, dg, ef, are called Ordinates rightly apply'd.

K 2

To

Part I.

To fi-d the La-

To find the Latus Reclum, TV.

Note. The Focus thro' which the Latus Rectum must pass, is distant from the Vertex A \( \frac{1}{4} \) of the Latus Rectum, which in this Example is 1.7. Thus having obtained the Latus Rectum, the Ordinates may be had thus, viz. The Rectangle of the Latus Rectum, and its intercepted Axis, is equal to the Square of the Ordinate. So that A w, A x, A y, A z, A a, multiplied by the Latus Rectum TV, is equal to the Square of T w, or ex squared, dy squared, cz squared, I B squared, b a squared. Therefore, A w 1.7 × T V 6.8 = to 11.56, whose Square Root = 3.4 = T w = w V. which drawing at right Angles to A C, gives the two Points T and V; and thus take any Distance in A C as A x, and multiply it by the Latus Rectum, the Square Root of that Product will give the two Points z and f; and after this manner may as many Points as you please be found, through which the Curve of the Parabola must pass.

Without the La-

Or, without the Latus Rectum, thus:

Having AC and GC given: As any Abscissa is to the Square of its semiradinate, so is any other Abscissa to the Square of its semiordinate.

To gauge a Frushum of a Parabolic Conoid.
The Rule.

How to gauge the Frustum EGIBKHF.

The RULE.

To the Sum and half Sum of the Square of the Bung and Head Diameters, add to of the Difference of the faid Squares; multiply the Sum by the Length within, equal to BD, and divide by 1077.15 for Ale, and by 882.354 for Wine Gallons.

An Example.

Example. Let the Dimensions be the same as in the Spheroid and Parabolic Spindle, viz. the Bung Diameter 31 Inches, the Head EF=IK=24, and the Length BD 32.5. What's the Content in Ale and Wine Gallons?

Operation.

Operation.

The Operation.

GH = 
$$\frac{31}{31}$$
 EF =  $\frac{24}{96}$   $\frac{31}{96}$   $\frac{93}{48}$  The Squares  $\left\{\begin{array}{ccc} 961 & \text{And } 961 - 576 = 385 \& \frac{1}{16} = 38.5 \\ 576 & \text{The Sum} & 1537 \\ \text{Half the Sum} & = 768.5 \\ \text{One Tenth} & = 38.5 \\ \text{One Tenth} & = 38.5 \\ \text{The Sum} & = 2344.0 \\ \text{B D} & = 32.5 \\ \hline & 11720 \\ 4688 & & \end{array}$ 

1077.15)76180.0000(71.07 Ale Gallons.

7032

Ale

882.354)76180.00000(86.34 Wine Gallons.

Wine

By the Sliding Rule.

By the Sliding

Multiply the Difference of the Head and Bung Diameters by Rule .58, add the Product to the Head Diameter, which reduceth the Cask into a Cylinder, then on the Lines C and D.

4. To gauge the lower Frustum of two Hyper- of the lower Frustum of two

Of the lower Frustum of two Hyperbolic Conoids,

See Plate 3. Fig. 4.

Definition. How to delineate an Hyperbola, in Plane, is Definition. shewed in page 78, and the lower Frustum of two Hyperbolic Conoids abutting upon one common Base is demonstrated AkpB BEFA.

Rula

The RULE. How to gauge this.

To the Sum of the Squares of the Bung and Head Diameters, add the Product of the Bung, multiplied by the Head Diameter; this Sum multiply by the Length of the Cask within, and divide the Product by 1077.15 and 882.354, this will give the Content in Ale and Wine Gallons.

Example.

Example. Let the Head = 24. Bung 31, and Length 32.5 Inches (as in the other Casks above) what's the Content in Ale and Wine Gallons?

Operation.

Oper	ration.

A B=31	kp = 24 24	$ \begin{array}{c} AB = 31 \\ kp = 24 \end{array} $
93	96	124 62
Square { 961 576 AB×kp 744	The Squares 576	The Product 744
The Sum 2281 Cd = 32.5		7
11405 4562 6843		

Ale.

1077.15)74132.5000(68.82 Ale Gallons.

Wine.

882.354)74132.50000(84.02 Wine Gallons.

By the Sliding Rule. By the Sliding Rule.

Multiply the Difference between Head and Bung by .52, and that Product added to the Head 24 makes 27.64, the mean Diameter, then on the Lines C and D.

Ale. Wine,

# 5. To gauge the lower Frustum of two Cones, abutting upon one common Base.

Of the lower Frustum of two Cones.

See Plate 3. Fig. 5.

Definition. This is explain'd in Plate 3. Fig. 5. in which Definition. DAE is a Cone, DFGE the lower Frustum, and DEIH is the lower Frustum of another Cone abutting upon the Base of the other Cone DE; so that FGEIKD represents this Cask, whose Stawes from Head to Bung are perfectly straight, as GE, &c. 'tis plain from the Figure that this Cask holds the least of all others; and to gauge it this is

#### The RULE.

Rule.

From the Sum and half the Sum of the Squares of the Bung and Head Diameters, subtract half the Square of the Difference of the two Diameters; multiply the Remainder by the Casks Length, and divide by 1077.15, and by 882.354, which will give the Content in Ale and Wine Gallons.

Example. Let the Dimensions be as before, viz. the Length Example. 32.5, Bung 31, and Head 24 Inches, I demand the Content in Ale and Wine Gallons?

Operation. Operation. DE = 31FG = 24DE = 31FG = 24 24 31 96 7 the Diff. 30 93 Square of 49 the Diff. 576 The Square 961 The Square of FG 576 Half the Square. 24.5

The Sum 1537
Half the Sum = 768.5

The Sum 2305.5
Subtract 24.5 Half Square of the Difference.

 $BC = \begin{array}{c} 2281.0 \\ 32.5 \\ \hline 11405 \\ 4562 \\ 6843 \end{array}$ 

1077.15 )74132.5000 ( 68.8 Ale Gallons.

882.354)74132.50000 (84. Wine Gallons K 4

Ale.

Wine,

th

216

Py the Sliding Rule.

By the Sliding-Rule.

The Common Multiplicator for Reducing of this Cask to a Cylinder is .51: So  $31 - 24 = 7 \times .51 = 3.57 + 24 = 27.57$  the Mean Diameter.

Ale. Wine,

And now I have finished all the Five Varieties of Casks,

Of the Ale and Wine Contents of the 5 Varieties of Casks, Their feveral Contents are,

		Ale	Wine	
1.	The Spheroid	75.37	92.01	
		74.78	91.28	
	The 3d Variety	71.07	86.34	- Gallons.
	The 4th Variety		84.02	
	The 5th Variety		84.	. 1

Note. You may find the Diameter at every Inch from Head to Bung, as has been taught in Page 115; and the Sum of the Areas, answering those Diameters, will be the true Content of the Vessel.

Of the Hyperbolic Spindle. 6. To describe an Hyperbolic Spindle.

See Plate 3. Fig. 6.

The Middle Frustum of which GAHICF shall reprefent a Cask, whose Diameter at the Bung AC = 31 Inches, the Diameter at the Heads GF, HI, are each 24 Inches, and the Length KL = 32.5 Inches; and to find the Content of this Frustum in Ale and Wine Gallons.

Draw the right Line DE, and at right Angles thereto the Line sC; make KB, and BL each equal to the half Length of the Cask; through the Points K and L draw the Lines KO and L q parallel to sC. Make KG and LH, each equal to 12, and BA=15.5, make Br=KG, so shall Ar be 3.5, I say the Square rG=264.0625 divided by Ar 3.5, gives 75.446, from which subtrast 3.5, rests 71.946 the transverse Diameter of the Hyperbola.

Make As = 28.94 (half of 57.88.) and through the Points draw the Line MN parallel to DE, and let the Line GO be parallel to sC; I say, the Square of sA, more the Square of Os, is equal to the Square of OG, of which the square of OG, is the Length of the Line OG. Now sB — OG = GK, which doubled gives GF, a Diameter in the Spindle; and this will hold wherever O or q be taken, and so innumerable Diameters GF, tw, HI may be found on both Sides AC to the Ends of the Spindle. And if Diameters be found enteres.

thus in the middle of every Inch from K to L, the Sum of those Areas answering, will be the Content of the middle Frustum of the H-periolic Spindle: This being more for Speculation than Use, I shall leave the Practice to the industrious Student.

### 7. Of a Circular Spindle.

Of the Circular] Spindle,

See Plate 3. Fig. 7.

Definition. If the Arch of a Circle CAD be turn'd about upon its Chord CD, it will describe a Solid CFAH, DIB GC, called a Circular Spindle.

To describe a Circular Spindle, the middle Frustums of which shall represent a Cask, whose Bung Diameter AB = 31 Inches, the Diameters at the Head FG, and HI, are each 23 Inches,

and the Length K L = 38.5.

To find the Content of such a Cask in Ale Gallons, divide the Square of the balf Length of the Cask by balf the Difference between the Head and Bung Diameters; and to the said balf Difference, the balf of this Sum is equal to the Radius AO; with which upon O (as a Center) describe the Arch MAN; draw MN, and AO at right Angles thereto: Make AE=15.5, the Semi-Diameter at the Bung. Draw CD parallel to MN, and make EB=AE, and draw the Arch GBID, (with the same Radius you drew the Semicircle) set off the Length of the Cask from K to L, through which Pointe draw Lines parallel to AB; so shall FG and HI be the Head Diameters of the Cask, and each 24 Inches.

To find the Diameter in the middle of every Inch from AB towards FG: Now because FP is parallel to AO, the Triangle PFO = Triangle FQq; consequently PO = Fq. Now by what is taught in Page 25, if from the Square of FO, (which is always equal to AO Radius,) you subtract the Square of PO, the square Root of the Remainder will be PF, from which subtract FK (being always given in the Question) there will remain PK, which will be always the same through-

out all the Parts of the Length of the Cask K L.

An Illustration of all the Process in Numbers.

An Illustration by Numbers.

KE=EL=19.25 fquar'd = 370.5625, divided by 4, half the Difference between the Head and Bung Diameters. Quot.  $92.64 \times 4 = 96.64$  half = 48.32 = AO = FO, then because PO = Fq; in the Triangle FPO, I find PF= 44.32 - FK 11.5 = KP 32.82, which is a constant standing Number; these Things being premised, let it be required to find a Diameter in the middle of every Inch from K to E = Fq, then the middle of the first Inch from F the Head Diameter will make Fq = 18.75 = PO, (for the Line FP approacheth nearer to AO, by so much as you take the Diameter farther from

Spindle.

from K, 'till at last FP will co-incide with AO,) whose Square taken (always) from 2334.8224, the Square of FO= 48.32, from whole Square Root take the flanding Number 32.82 = PK, there will remain half the Diameter fought, which I have thus calculated, and inferted in the following Table, with their Area's.

A Table of half A TABLE shewing the Content of balf the middle Frustum the middle Frufof the Circular Spindle F A B G. tum of a Circular

See Plate 3. Fig. 7.

Distance from	Diameters in Inches.	Areas in Ale Gallons.		
GF=0  -5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5 18.5	23 00 23 42 24 24 25 00 25 72 26 38 27 00 27 58 28 10 28 58 29 00 29 40 29 74 30 04 30 30 30 54 30 94 30 98	1.53 1.64 1.74 1.84 1.94 2.03 2.12 2.20 2.27 2.34 2.41 2.46 2.51 2.56 2.60 2.62 2.64 2.66 2.67		
19.25 31.00 0.67  The Sum 43.45  Double the Sum 86.90				

So the Content of the Frustum FAHIBG is 86.90 Ale

Here you see I have (according to the Doctrine above) calculated the Diameters in the middle of every Inch, from the Head G F, towards the Bung AB, and 19 of those Area's gauges the Frustum to 19 Inches from the Head GF; and because there is one Quarter of an Inch more, I take \$\frac{1}{4}\$ of the Area answering the Bung-Diameter 31, viz. \$\frac{1}{4}\$ of 2.68

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to Fold out fact o page 138 part 1 .

page 126

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0.67 Parts of a Gallon, which I add to the other Areas, and the Sum is as you fee in the Table annexed. The Operation for the Diameter of the middle of the second Inch from GF, that is at 1.5 from the Head stands thus, GF = 19.25 -1.5 = 17.75  $\Box$  = 315.0625; then FO  $\Box$  = 2334.8224 - 315.0625 = 2019.7599  $\Box$   $\checkmark$  = 44.94 = FP - PK 32.82 = 12.12 + 12.12 = 24.24, the *Diameter* in the *mid-dle* of the *second Inch.* Note. You must now suppose FP to be moved nearer to AO 1.5 Inch, &c.

#### CHAP. XXIV.

To find the ULLAGE of a CASK.

Of ullaging Cafks.

See Plate 4. Fig. 4.



Definition. HE Ullaging of Casks is to find how Definition. much Liquor there is in it, when it is not full; which taken from the whole

Content, gives what it wants to fill it up; or, by knowing the Vacuity, and

fubtracting it from the whole Content, it leaves the Ullage, or the Quantity of Liquor then in the Cask.

\* Several Writers on this Subject have shewn how to ullage a Cask by a Table of Segments, calculated for a Cylindrical Cask; but because that requires you always to have that Table ready at Hand, and doth not always agree with the Lines of Segments on the Sliding Rule, I shall here omit it, and shew how to effect the same by Pen and Sliding Rule.

1. By the Pen, for a lying Cask.

By the Pen

#### The RULE.

The Rule,

Divide the wet or dry Inches by the Bung Diameter, and if the Quotient be under .500, subtract from the Quotient a fourth Part of that Quotient which would make it 500, and the Remainder is a Decimal Fraction. Multiply by the Content.

2. But if the Quotient be above .500, add to it 1 Part of the Excess above .500 to the said Quotient; which Sum multiply'd by the Cask's Content gives the Liquor in the Cask, if you took the wet Inches; but if the Dividend was the dry Inches; the Product is what it wants to fill it up.

Example.

### Of Allaging Casks.

Part I.

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Caj

Example in a Spheroidal Case.

Example, in a Spheroidal Cask.

Admit the

Length 32.5
Bung Diameter 31.
Wet 21.
Dry 10
Content 75.37 Ale Gallons.

What is in the Cask.

I demand what Drink is there in the Cask, and how many Gallons will fill it up?

Operation,

Operation.

The Area of the Segment .721774
The Content of the Cask 75.37 Ale Gallons.

In the Cask 54.40010638 Ale Gallons.

What will fill it up.

2. For the Vacuity, or what will fill it up.

The Area of the Segment .278225
The Content of the Cask 75.37 Ale Gallons.

1947575 834675 1391125 1947575

Wants to fill the Cask 20.96981825
Add what is in the Cask 54.40010638

The Sum is the Cask's Content 75.36992463 Ale Gallons.

Note.

\* N.B. The .5, may be called .50, or .5000, or .50000, or .50000, &c. to fill up the Number of Decimal Places: in the Rule above it is called .500,

Note. This Rule above being adapted to Casks nearer to a A Note. Cylindrical Form, than to a Spheroidal Form; the Segments, and consequently the two Quantities, viz. the remaining Liquor in the Cask and the Vacuity will differ from those found by the Lines of Segments, on the Sliding-Rule; because those Segment Lines are adapted to Spheroidal Casks.

2. By the Sliding-Rule.

By the fliding

1. As the Bung-Diameter, on the Line of Numbers on the Little Slider, marked N,

Is to 100, on the Line of Segments marked S L, So is the Wet or Dry Inches on the Line of Numbers N, To a Segment upon S L; which referve.

2. As 100 upon A,
Is to the Cask's Content upon B,
So is the reserved Segment upon A,
To the Quantity of Liquor in the Cask.

N.
Bung. SL. Wet. SL.

As 31 is to 100, so is 2.1 to 73.8

A. B. A. B.

As 100 is to 75.37 so is 73.8 to 55.6.

Radius. Content. Segm. Ullage.

For the Vacuity, by the Sliding-Rule.

Here you must work in all respects as you did for the Ullage; only instead of the Wet Inches, you must now make use of the Dry Inches.

Operation.

Operation,

N. N. N. Bung. S. L. Dry. Seg.

As 31 is to 100 fo is 10 to 26.2, referve this Segment.

A. B. A. B.

As 100 is to 75.37 so is 26.2 to 19.7 the Vacuity.

Radius. Content. Segm.

In the Cask, add 55.6

The Sum is the Content 75.3 Ale Gallons.

2. To find the Ullage of a Cask, when the Axis To ullage a Cafk is perpendicular to the Horizon.

flanding upon one End.

See Plate 4. Fig. 5.

1. To calculate any Diameter between the Bung and Head, and by fuch Diameter to find the Quantity of Liquor in the Cask when it is Part empty.

The

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32.

The Rule.

#### The RULE.

1. From the Square of the Bung-Diameter fubtract the Square of the Head-Diameter, and divide the Square Root of the Remainder by half the Cask's Length.

2. Multiply this Quotient by the Number of Inches which the Diameter fought is distant from the Bung, and call this

Product, your Subducend.

Lastly. From the Square of the Bung-Diameter, subtract the Square of your Subducend, and the Square Root of the Remainder is the Diameter sought.

Another Rule.

### Or, fay,

As the Square of half the Cask's Length,

Is to the Difference of the Squares of the Bung and Head-Diameters,

So is the Square of the Distance from the Bung and Liquor's Surface,

To the Difference of the Square of the Bung-Diameter and Diameter of the Liquor's Surface.

An Example,

Example. Let us suppose a Spheroidal Cask posited as before, the Length 32.5 Inches, the Bung 27, the Head 23, the Content of this Cask will be 59.95 Ale Gallons. Then let the Wet Inches be 8.5; I demand the Diameter DF, and how much Liquor there is in the Cask?

Operation.

#### For the Diameter DF.

H I= 27		BG= 32.5
27		BK= 16.25
		BK= 16.25
189	69	
54	46	8125
		3250
The Square 729	The Square 529	9750
Square 529		1625
	KG= 16.25 Square of B I	
The Differ. 200	EG= 8.5	264.0625

7.75 9=60.0625

Now, fay,

As 264.0625 is to 200, so is 60.0625 to 45.49. Square B.K. Diff. Diff. Diff.

From the Square of H I= 729. Subtract 45.49

683.51(26.1 = DF.

Now,

Now, for the Content of the Frustum DFM L, by Rule 2. Page 128.

To twice the Square DF = 1367.02 Add the Square LM = 529.

The Sum = 1896.02 The Wet Inches 948010 1516816

1077.15)16116.1700(14.95 Ale Gallons. The Cafk's whole Content .... 59.95

There wants to fill the Cask 45.00

If the Cask bulge but a little, divide the Wet or Dry Inches Of Casks a little by the Cask's Length, and if the Quotient exceeds 500, add bulging. to the faid Quotient 10 Part of the Excess; but if it be under 500, subtract 10 Part of what it wants of 500, and the Sum or Remainder is a Decimal Fraction, by which multiply the Content of the Cask, and the Product will be the Quantity of Liquor therein, if the Dividend was the Wet Inches; but if it was the Dry Inches, it gives the Vacuity, or what it wants to fill it up.

See both Operations.

Operation.

Wet. .5000 From Dry. 32.5)8.50000(.2615 325)24.00000(.7384 .5000 Subtract 10).2385 (0.2385+ 10).2384(.02385+ The Wet Quotient .2615 The Dry Quotient. .7384 10 of wants of 5000 = .02385of Excess .02385+ The Segment . 76225 The Segment .23765 The Content 59.95 The Content 59.95 118825 381125 213885 686025 213885 686025 118825 381125 The Ullage 14.2471175 45.6968875 The Vacuity 45.6968875

The Content 59.9440050 Proof.

The Ullage by the Sliding-Rule. For the Ullage. By the Sliding-Rule.

Radius. N. Wet. Seg. Length S. S. A. As 32.5 is to 100 fo is 8.5 to 24. As 100 is to 59.95 fois 24 to 14.3 Radius Content Seg. Ulla

For the Vacuity.

N.

Length. S.S. Dry. Seg. A. As 32.5 is to 100 fois 24 to 76. As 100 is to 59.95 fo is 76 to 45.6 The Ullage added 14.3

The Cask's Content in Ale Gallons

### CHAP. XXV.

Of Warm Worts,

How to gauge WARM WORTS.



ETHEN the Parliament laid on the Excise Duty, it was enacted that for every Ten Gallons of bot Wort gauged, there should be an Allowance of one Gallon for Waste; for 'tis found by Experience, that every Ten Gallons of hot Wort will be but Nine when cold.

The Country People do commonly cool their Worts in Brass Pans, whose Diameter is about 28 Inches, and Depth 10 Inches more or less; and these are commonly deeper in the middle than at the Side by an Inch or two; therefore with your Rule take the Diameter of the Liquor's Surface by drawing out the Slider B, and pin it fast. Then draw out the other Slider 'till it touch the Side of the Pan, and on its Infide is shewn both the Diameter and Area in Ale Gallons; which multiply by the Depth (taken about the Middle between the Center and the Side) the Product will be the Content near enough the Truth.

Or,

On the Line C and D, fet the Depth to the Ale Gauge-Point, 18.94, and against the Diameter on D, is the Content on C.

If the Wort be cooling in an Elliptical Vessel, (as I have often known) take the cross Diameters, and work as in the Ellipsis, Page 80, for the Area: And because now we are not only to find the Area, but also the Content, therefore this Area multiplied by the Depth gives the Content.

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Or.

Find a Geometrical Mean between the two Diameters, and then on the Lines C and D, you may gauge it as a Circle.

Example. Let one of the Diameters be 61 Inches; and the An Example, other 47.5, and the Depth 11.2 Inches: I demand how much Wort there is in the Tub.

For the Mean, as in Page 43.

C D

As 61 is to 61, fo is 47.5 to 53.8 the mean Diameter.

Diam. Diam. Diam.

For the Content.

2. For the Con-

1. For the Mean.

tent.

As 18.94 is to 11.2, fo is 53.8 to 90.3. the Content in Ale Gall. G.Pt. Depth. Mean.

And when you find the Wort in round Bowls, you must of Worts in small gauge them as Segments of a Globe; but in Practice rather Vessels, than the Officer should take so much Trouble, as to stand gauging every little Vessel, desire the Brewer thereof to put several small Quantities together into one Vessel, and that will save both the Officer a great deal of Trouble, as well as do the Owner the more Justice.

When you insert the warm Gauge in your Stock-Book, you must put a w. over it, that so you may distinguish your warm Gauges from the other; that in casting them up you may make the proper Allowance of One Gallon in Ten, as

the Law directs.

How to deduct one Gallon in ten from warm of deducting one Gallon in 10, for warm Wort.

Now, the Deduction of I Gallon in 10 may be done either by Subtraction, or by Multiplication. It is done by Subtraction, by fetting the Number of warm Gallons down twice, the under Number must be placed one Place more to the Right Hand, and subtract as usual: The Remainder is the Quantity of Wort to be charged.

Or

Multiply the Number of warm Gallons by .9 a Decimal, and the Product will give the Neat Gallons.

Example. Let the Gauge of warm Worts be 90.3 Gallons, An Example, what must be charged?

Subtract 90.3

Subtract 90.3

Multiply 90.3

Neat Gallons 81.27

Neat Gallons 81.27

Neat Gallons 81.27

N

### Of gauging Warm Worts. Part I.

Of fmall Elliptical Tubse

Note. In small Elliptical Tubs you may find the Area near

enough in Practice: Thus,

Find, by drawing out the Rule, the Area of the longest Diameter, and in like manner the Area of the Shortest Diameter, balf the Sum of these two is the Area sought.

lons by the Diameter and Depth.

of the Neat Gal- How to find the Neat Gallons at one Operation by the Diameter and Depth.

> But if the Wort be in open Tubs, on which you have fix'd Areas, take the Diameter and Depth (as above directed) on the Lines C and D. Instead of the Ale Gauge-Point 18.94, make use of 20; to which set the Depth on C. And against the Diameter on D is the Content of Neat Wort on C. As for Instance, In the Elliptical Tub I found the mean Diameter to be 53.8 and the Depth 11.2, what are the Neat Gallons ?

D. As 20 is to 11.2 fo is 53.8 to 81.3 the Neat Gallons. G. Pt. Depth. Mean.

To cast up warm Gauges by the Area and Depth.

How to cast up a warm Gauge by the Area and Depth.

But if your warm Gauge be in a Tub, which you have in your Stock-Book upon Areas, then the two Lines A and B must be used. For, As 1 upon A, is to .9 upon B, so is any Number of warm Worts upon A, to the Neat Gallons

A New Muliplieator found.

Suppose as before, the warm Gallons are 90.3; what's the Near?

As 1 is to .9 fo is 90.3 to 81.3 the Neat Gallons. Unity. Factor. Warm W.

Warm Gauges how cast up.

Set I upon A to .o upon B, and against I upon B, is II.1 upon A, a new Multiplier; which will perform the same as .9 doth. But if you call the .9 Nine whole, then will the t be 10. on the Rule.

As 11.1 is to 10 fo is 90.3 to 81.3 Neat Gallons, as before. Fast. Warm W.

And from what goes before, it is easy to conceive, that warm Gauges, which are taken in Tubs, which stand upon Areas, may be cast up at one Operation by the Rule, with the Allowance of one Gallon in ten deducted

Example.

### Chap. XXVI. To reduce Me Bealure, &c.

Example. The Area of the mean Diameter 53.8 is 8.06, An Example, and the Depth 11.2 Inches, what's the Neat Gallons?

R. As 11.1 is to 11.2 so is 80.6 to 81.3 the Neat Gallens. Mult. Depth. Area.

By these Rules I have shewn how warm Gauges are cast up, either by their Areas or Diameters, at one Operation by the Sliding-Rule.

See Part II. Chap. II. Page 9.

#### CHAP. XXVI.

How to reduce Ale Measure to Wine, Corn, &c. Of reducing Ale to Wine Meaè Contra. fure, &c.

OST Officers of Excise make use of this Proportion, as 9 to 11, so is the Wine Gallon to the Ale Gallon; but this is not exact, as I prove by this Proportion.

As 231 is to 282 fo is 9 to 10 228, which they take for 11. Common Method But to remedy this Imperfection, you may find Multipli- To find Multiplicators, which will do the Work at one Operation, thus.

> As 231 is to 282 fo is 1 to 1.220779. As 282 is to 231 fo is 1 to .819148.

And for the Malt Bushel the Factors are thus found.

As 282 is to 2105.4 fo is 1 to 7.6256.

As 2150.4 is to 282 fo is 1 to .131137. As 231 is to 2150.4 fois 1 to 9.3092.

As 2150.4 is to 231 fo is 1 to .107422.

By which I have found the Factors for Reducing

Ale to Wine is 1.220779 Wine to Ale .819148 .131137 Ale to Corn Corn to Ale 7.625602 Wine to Corn .107422 Corn to Wine 9.309177.

To find Multie plicators for the Malt Bushel.

Table of the Fac-

EXAMPLES.

Examples.

In 231 Gallons of Ale, how many Gallons of Wine? Ale to Wine, 231 X 1.220779 = 282 Wine Gallons:

In

Wine to Ale.

In 282 Gallons of Wine, how many Gallons of Ale? 282 X .819148 = 231 Ale Gallons.

Malt to Ale.

In 282 Bushels of Malt, how many Gallons of Ale? 282 X 7.625602 = 2150.42 Gallons of Ale?

Malt to Wine.

In 231 Bushels of Malt, how many Gallons of Wine? 231 × 9.309177 = 2150.42 Gallons of Wine.

And a Cistern that holds 80 Bushels of Barley, will hold 610.04776 Gallons of Ale.

Of the Corn Gal-

If instead of the Corn (or Malt) Bushel you will have the Corn Gallon, it is no more than 1/8 Part of 2150.42 fere; which is \* 268.802294375 Cubick Inches; as will be made more manifest when we come to treat of Malt Gauging.

Note, By the above Rules you may find Factors for the Reducing of Ale, Wine, Malt, &c. to Tallow, Soap or Starch.

### CHAP. XXVII.

Of Malt Gauging.

Of MALT-GAUGING.



A Winchester Bu
N the Year 1696, when the Parliament laid a
thel what.

Duty of 6 d. per Bushel upon Malt made in England, either for publick or private Use; it was then also ordered, that the Busbel should contain 18 1 Inches Diameter throughout, and

8 Inches deep, with a plain and even Bottom; and that this should be deemed a legal Winchester Bushel, by which all Barley or Malt should be gauged; the Cubick Inches in this Bushel are thus found.

how found.

The Cubic Inches As 1 is to 3.14159 so is 18.5 to 58.119415 the Circumference. Half the Circumference 29.0597075 × ½ Diameter 9.25 = 268.802294375 the Area × Depth 8 Inches = 2150.418355 the Square Inches in a legal Winchester Bushel. See Page 48. Now, 2150.418355 X 1.2732406 = 2737.99995657121:

But I have all along omitted the Fraction, and increased the Of the Divisor and whole Number one Unite; so that 2738 may fafely be taken Gauge Point for for a Divisor for a Circular Malt Bushel; and their Square a Circular Malt Roots are 46.37, and 52.32 the Gauge-Points, as inserted in Bushel. See page 1 7. Bushel. See page the Table, Page 50. But that you may have a Bushel and. its Parts, with their Divisors and Gauge-Points ready at

hand, take them in this Table.

## A TABLE of Divifors and Gauge-Points for Corn or Malt.

For a SQUARE.			For a CIRCLE.			A Table of Divi- fors and Gauge
A Bufbel and its Parts.	Divisors.	Gauge Points	A Bujbel and its Parts.	Divisors.	Gauge Points	Points for Malt, either square or circular.
Buthel  Buthel  Buthel  Peck  Peck  Peck  Peck  Peck	2150.4184 1075.2092 537.6046 268.8023 134.40115 67.20057	32.79 23.18 16.39 11.59	Peck 1 Gallon*	2737.9995 1368.9998 684.4999 342.2499 171.1249 85.5624	52.32 36.99 26.16 18.49 13.08 9.25	See Dry Measure, on Page 6.

The Use of the above Table is to examine any Bushel, Half The Use of the Bushel, Peck, &c. whether they be true Measure according Table, to the Standard now remaining in his Majesty's Exchequer: For, take the Depth and Diameter (suppose the half Bushel) then, As the Gauge-Point 36.99 on D, is to the Depth on C, so is the Diameter on D, to I on C, if it be true Measure.

I have shewn, as I went on in this Treatise, how to find

the Area and Content of every Figure in Malt Bushel; therefore it needs not be here repeated: it remains now to shew how Of gauging Cisto gauge Cisterns, Couches, and Floors, and from whence the terns, Couches, Charge doth arise.

When the Barley is wet, or Reeped in the Cistern, it swells, of the Swelling and is about one fifth Part more than when first put in; that of Barley in the is, four Bushels in twenty is to be allowed in the Cistern and Cistern. Couch; and to find a Multiplicator to give the Neat Duty from Cistern or Couch, this is

The RULE.

The Ruk.

 $20 - \frac{7}{5} = \frac{4}{5}$  whose Decimal is .8.

See the Work at large.

From 20 Subtract 4 equal to  $\frac{1}{3}$ 

Remains 16 equal to 4 which is reduced

to a Decimal

Thus, 5)40(.8

L 3

When the t. Progr to Except on the

<sup>\*</sup> Because two Gallons are one Peck, I call the Half-Peck in the Circular Measure one Gallon.

Part I.

So that any Number of Gross Bushels from Ciftern or Couch multiplied by .8 will give the Neat Bushels.

An Example.

Example. Suppose a Cistern's Length 85 Inches, Breadth 54.4 Inches, and Depth 36 Inches; and just before the Draining of it I have a Gauge exactly full: What's the Content and Neat Bushels?

85 × 54.4 × 36=166464 folid Inches, divided by 2150.4 = 77.4 Bushels Gross, × .8 = 61.92 Neat Bushels.

By the Sliding Rule, By the Sliding-Rule.

As the Depth of the Ciftern, &c. on the Line MD, Is to the Length, or Breadth, on the Line of Numbers on the Slider, marked N, So is the Length, or Breadth, on A, To the Content on B.

As \ MD. N. A. B. Depth. Length. Breadth. Content. 36 is to 85 so is 54.4 to 77.4 Bushels Gross.

The same Order is to be observed in casting up Couch and Floor-Gauges by the Rule.

A Note.

Note. You are to set your Cisterns upon Areas, with the Length, Breadth, and Depth, in the proper Column, in your Malt-Book, thus,

Depth 36
Length 85
Breadth 54.4
Area 2.15 Buffels.

Now, the Area multiplied by the Depth 36 = 77.4 the Content as before.

How to gauge a

How to gauge a Couch.

With your Tape take the Length and Breadth of the Couch, which you must insert in your Book: Then with your Dimension Cane and Brass, take six, eight, or ten Depths (as was shewed in gauging the Cooler, Page 120,) more or less, as you shall see Occasion. Dividing the Sum of them by the Number of Depths, gives a mean Depth; which insert in your Malt-Book.

What a Couch, How to know when it is a Couch, and when a Floor.

See the Instructions relating to the Malster bown long the Barley has been out of the Cistern. the Duty on Malt If it is under Thirty Hours, it is deemed by the Law a Couch, Art. 4.

which must be gauged, and the Allowance of Four Bushels in Towenty given, as was shewed in the Cistern: But if he declares the Barley has been out of the Cistern more than Thirty Hours, it is to be taken as a Floor, and the Allowance made of Ten Bushels in Towenty: And then it remains a Floor 'till it comes to the Kiln to be dried.

In order to find a Multiplicator that will give the neat A Multiplication Bushels from the Floor; observe, that 10 Bushels in 20 be-for neat Floor ing allowed for the spritting, or growing of the Malt, it will Bushels. be this Decimal .5 for a Multiplier, that will reduce the gross Bushels on the Floor, to the neat Bushels.

#### How to take Floor Gauges.

How to take Floor Gauges.

Floor Gauges are taken in all respects as a Couch Gauge before directed; and cast up by the sliding Rule the same way as a Couch, by the MD Line above taught. Then let us suppose a Floor Gauge, when cast up and multiply'd by .5, to exceed the Cistern, or Couch Gauge of the same Barley, when multiplied by .8, then I say the Charge doth arise from such Floor, but when the Cistern or Couch is most, then you must make the Charge from that accordingly.

How to distinguish whether the Charge will arise Whence the from the Cistern, the Couch, or the Floor Charge will arise. Gauge.

But the usual way of finding whether the Amount of the Cistern or Couch, (allowing 4 in 20, that is \( \frac{1}{3} \) Part) or the Amount of the Floor, (allowing 10 in 20) makes the best Charge, is to multiply the Cistern or Couch Bushels by 1.6, and the Product will be a Number of Floor Bushels, equal in Charge to those Couch, &c. Bushels.

Or.

Another Rule

Multiply the Floor Bushels by .625, and the Product will be the Number of Couch Bushels equal in Charge to those Floor Bushels.

#### How the two Factors are found,

How the Factors

These two Multiplicators are found thus, viz. the Allowance of 4 in 20 is found before to be equal to .8, and of 10 in 20 to .5. Therefore,

As .5 is to .8, fo is 1 to 1.6. And as .8 is to .5, fo is 1 to .625.

Or, by dividing of Unity, thus: .625)1.0000(1.6 1.6)1.0000(.625.

LA

Now,

Part I.

Now let us suppose a Floor Gauge to be 100.8 Bushels, and the same from the best Couch Gauge 63.6, I demand from whence the Charge will arise?

100.8 × .625 = 63 Bushels, which is less than the Couch, therefore the Charge doth arise from the Couch.

terns, Couches, and Floors,

of Circular Cif- How to gauge Circular Cifterns, Couches, or Floors.

It frequently happens the Maltsters do wet their Barley in Round, or Elliptical Tubs, which if it be regular, you may fet upon a mean Diameter, otherways upon two or three, as you shall see Occasion: And if it is Elliptical, you must take the Cross Diameter, and insert them in your Malt Book, as a By-Tub.

Then if it is a Circle, the Square of the Diameter, multiplied by .0003653, or divided by 2738 (See Page 50.) will be the Area in Malt Bushels; which multiplied by the Depth, gives

the Content.

To gauge a By-Tub.

How to gauge a By-Tub: By the Sliding-Rule.

On the Lines C and D.

As the Gauge Point on D = 52.32 marked MR, Is to Unity on C, So is the Diameter on D, To the Area on C.

Here note, that if the Diameter be less than 52.32 Inches, then the Area will be less than one Bushel.

For the Content.

As the Gauge Point 52.32 on D, Is to the Depth on C, So is the Diameter on D. To the Content in Malt Bushels on C.

Points.

Of Square Gauge The Use of the Square Gauge Points in the Table, Page 50, is this.

> Having a Square or Oblong Ciftern, Couch or Floor, the Gauges thereon depending may be cast up by the sliding Rule on the Lines C and D.

> > For as the Gauge Point 46.37 on D, marked S R, Is to the Depth on C, So is the Side of the Square, (or Mean if an Oblong) on D, To the Content in Malt Bushels on C.

> > > Example.

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Example. In the Ciftern above (which we gauged by the An Example, Line of Malt Depth) whose Length 85, Breadth 54.4, Depth 36 Inches, what's the Content?

First, the mean between the Length 85, and Breadth 54.4

is 68. Then

D. As 46.37 is to 36, so is 68 to 77.4, the Content in Malt G. Pt. Depth Mean Bushels as before, when cast up by the Line called the Malt Depth, marked M D.

How the Officers of Excise are to money their How to money your Charges, Charge.

The Officers of his Majesty's Revenue of Excise make up their Accompts against each Sitting Day by Help of certain Tables, one of which is calculated for the Ciftern and Couch Gauges, and the other for the Floor, each of them giving the proper Allowance.

Charg'd from the { Couch 63 1. 1 5 2 1.6 Floor 100 1. 1 5 0 0 Cash 1. 2 10

Note. The Decimal Parts of a Bufbel are never charg'd, A Note,

but carried forward to the next Book.

The Law having given the Allowance of four Bushels in A Caution. Twenty on the Ciftern and Couch Gauges, and Ten in Twenty on the Floor; therefore if an Officer do not advance in his Gauges according to these Proportions, he must expect to incur the Honourable Commissioners highest Displeasure. How shall he examine his Gauges in this Case? This is

#### The RULE.

The Rule for ex-

Subtract the first Cistern Gauge from the best Gauge. If Gauges, this Difference be \(\frac{1}{5}\) of the first Gauge in the Cistern, then you have advanced according to Law; otherways not: But in this Case you ought to take the first Gauge in the Cistern of the Dry Barley, or very speedily after it is Wet: And if the Barley be damaged, the best Gauge will not advance \frac{1}{5} above the Dry Barley; but if the Barley be very good, it will advance above Fart, as I have often by Experience found to be true.

Example. Admit a Cistern whose Area is .86, in which An Example, you have a Gauge of Barley one Hour Wet, Depth 16, Content 13.8 Bufbels, and the best Gauge 15 Bufbels from the Couch, I demand what is the Advance? Whether \frac{1}{3} according to Law, more or less.

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15-13.8 = 1.2, which should be  $2.77 = \frac{7}{5}$  of 13.8, which is too little by 1.57. For this you must write a Reason of damaged Barley, or the like; otherways your Supervisor will Diary you for fuch a Fault.

By the fliding Rule.

By the Sliding Rule.

First take tof 1, which is .2, by which multiply the first Ciftern Gauge, and the Product is 1 of it.

As 1 is to .2, so is 13.8 to 2.77, this added to 13.8=16.57, which the best Gauge should have been, had it advanced four Bushels in Twenty, or 3.

Cash Tables how made.

How the Cash-Tables are made.

The Cash Tables for moneying the Cistern and Couch Gauges are thus made.

Bush. d. Bu. d.

If 1:6::.8:4:2.2, this is the first Number in the Table; which added continually to it felf, and so on, compleats that Table.

For the Floor.

Bufb. d. Bu. d.

If 1:6::.5: 3, this is the first Number in the Table, which added continually compleats that Table.

Every one making Malt for his Family-Use only, has Liberty to compound at 5 s. per Head.

See Part II. Chap. III. Page 19.

#### CHAP. XXVIII.

Of Candles.

## Of CANDLES.

The Duty on Wax and Tallow Candles.

& Anne, Chap. 9.

HE Duty upon Candles made of Tallow is a Penny a Pound, and upon Candles made of Was Penny a Pound, and upon Candles made of Wan Eight-pence a Pound, and all other Candles imported, made of Tallow or Wax, are liable to the fame Duty, viz. the 1st of May, 1710.

Tallow Candles became chargeable with a Duty of a Half-9 Anne, Chap. 6. a Pound; and wax Candles with a Duty of Four-pence became subject to an additional Duty of a Halfpenny a Pound, and the latter to an additional Duty of Four-pence a Pound.

Rush-Lights.

Note. Small Rush-Lights once dipt are not chargeable.

The

The above Duties were laid for 32 Years, but were afterwards made perpetual.

All Candles exported are to be re-allowed the Duty paid; Candles Exported

but such Candles being re-landed are forfeited.

The Statute Hours for Working, under the Penalty of Ten 7. Pounds, are from 7 in the Morning 'till 5 in the Evening, being, twixt the 29th of September and the 25th of March; and from 5 in the Morning 'till 7 in the Evening, betwixt the 25th of March and the 29th of September.

It has been found that 30.28 Cubic Inches are contained The Cubic Inches in one Pound of dry Tallow Averdupoize; and therefore is a Tallow. Divisor in all Square Measure, which multiplied by 1.2732406 See Page 47. produceth 38.55 the Divisor for Circular Measure, whose Square Root is 6.208 the Gauge-Point on the Sliding-Rule, and is marked with T. P. on the Line D, fignifying Tallow Pounds. And there are contained in an Ale Gallon 149 Ounces of dry Tallow Averdupoize Weight; fo that if any Gauge of Tallow be cast up as an Ale Gauge, the Total multiplied by 9.3125 (which are the Pounds and Parts in a Gallon) will give the Content: This Number 9.3125 is found thus,

As 16 is to 1 fo is 149 to 9.3125

Note. That 108 Pounds can only be charged in Candles A Note. for every 112 Pounds of Tallow missing; therefore multiply the Quantity of Tallow missing by this Decimal .964, and the Product will give the Neat Weight or Quantity that is to be charged.

This Decimal .964 is thus found.

As 112 is to 1 fo is 108 to .964.

Note. Any Family may compound at 1 s. per Head, for Candles made for their own Use.

See Chap. VI. Page 34. of the 2d Part.

#### CHAP. XXIX.

#### Of the DISTILLERY.

Of the Distillery.



Pitch that can be arrived at by Man in Gau-rious Part of ging; for it is not only required, that he should Gauging. be very expert in Gauging, but also in the Manner of Book-keeping, and making up the Ac-

compts; which is more difficult than any other Branch of this Art.

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Some Officers ne-

Hence, because every Officer of Excise (I well know) is not verinstructed in it. instructed in the Distillery, neither has an Opportunity of seeing any Thing of it in all his Days; by what follows he may come to have some small Notion, if not become a perfect Master of that Abstruse Art.

The Materials, &c. used by Distillers are characteris'd as Characters for Distillers Materials. follows.

For Melaffes.———M	There are some other Characters,
For Malt. — G	viz. For a Still.
For Cyder.————————————————————————————————————	Not come down. ——— O
For Sugar-Water.——S	Newly come down.—— V
For Foreign Fruit. ——F	About half down
For Brewers Wash or Tilts B	Near off.
For Wine. — W	Quite offOff.
For Wine. W For Low Wine. LW	

How to gauge a Still has been shewn on Page 123,

By the Tenth and Eleventh of William III. and Fourth of Directions for charging Distillers. Anne, 'tis Enacted:

> That all Wash made of Welasses for Distillation shall be charged with one fourth Part into Low Wines, and two third Parts of fuch Low Wines into Spirits.

> Alfo. That all Waft from Balt or Balted Corn fhall be charged with one fourth Part into Low Mines, and three fifth Parts of fuch Low Wines into Spirits.

> And, That all Wash made from Tyder or Perry be charged with one firth Part into Low Wines, and one half fuch Low Wines into Spirits.

> All Spirits made or drawn by any Diffiller from any Mirture of Spirits with any kind of Wash (ercept Common Water) fhall be deemed and taken to be Low Wines, and shall be charged with the Duties already fet and impoled upon Low Wines drainn from Foreign Baterials.

> Gaugers shall keep an Account of all Melasses Wash in Diffiller's hands; and upon Decrease thereof, charge so much Low Wines as 1 Part of the Wash shall amount to; and charge him with to much Proof Spirits as ? of the Low Wines to charged hall amount to-

> Gaugers shall also charge 1 Low Wines from the Decrease of Malt Wash, and 3 of Spirits from such Low Wines; and 1 of Low Wines from the Decrease of Cyder. 02 Perry Wash; and 1 of Spirits from furh Low Wines.

> Note. Melasses-Wash decreases into Low Wines, and fuch Low Wines 2 into Spirits.

> Officers wittingly charging Low Wines as from Corn, knowing them to be such, forfeit their Office and 10 s. per Gallon.

> > The.

The Statute Hours for Distillers carrying out any Liquors, Hours for carrying under the Penalty of 101. are from 3 in the Morning to 9 at out Liquors. Night betwixt the 25th of March and the 29th of September; 7 & 8 Will. III, and from 5 in the Morning to 8 at Night, from the 29th of September to the 25th of March.

The Fractions mention'd in the Act are these, and are also Of the Fractions reduced to Decimals.

Vulgar Fractions 
$$\begin{cases} \frac{1}{4} & \frac{2}{3} \\ \frac{3}{5} & \frac{1}{3} \end{cases}$$
 the Decimals are 
$$\begin{cases} .25 \\ .666 \\ .6 \\ .2 \\ .5 \end{cases}$$
 Factors.

That is,

From Malted Corn \(\frac{1}{4}\) and \(\frac{3}{5}\).

From Cyder and Perry \(\frac{1}{5}\) and \(\frac{1}{2}\).

From Melasses \(\frac{1}{4}\) and \(\frac{2}{3}\).

From all English Materials, as Cyder, Perry, Turneps, &c. \(\frac{1}{5}\) and \(\frac{1}{2}\).

Now you are to observe, that any Quantity of Melasses For Mellasses Wash, being multiply'd by .25 gives Low Wines, and Low Wash. Wines multiply'd by .666 give Spirits.

Wines multiply'd by .666 give Spirits.

And any Quantity of Malt Wash being multiply'd by .25, For Malt Wash.

gives Low Wines; and fuch Low Wines being multiply'd by

.6, give Spirits.

Lastly. And any Quantity of Wash from Cyder or Perry, For Cyder and being multiply'd by .2, gives Low Wines, and such Low Wines Perry Wash. multiply'd by .5, give Spirits.

The Reader will find all these Rules exemplified in the

Course of this Chapter.

#### How the Officer is to make his Surveys.

The first Thing that you do in the Morning, is to go to the How to make Still-house, to see if they be at work. If they be not, then Surveys in the Still. Column of your Minute Book write filent. And then take an Account of the Wash Backs; and put the Depths

down distinctly in their proper Columns.

In the Morning if you find the Distiller at Work, observe what he is stilling, whether Melasses-Wash, Malt-Wash, Faints, or Low Wines. If he be distilling either Wash or Faints, then for every Still that there is at Work, put an a in that Still Column, if two Stills at Work put two a's thus, a a: But if he be stilling Low Wines, then for every Still at work write so many b's: But if two Stills at work, the one stilling Melasses Wash, and the other stilling Low Wines, then write an A and a b: When you find them distilling Spirits, which is called Redissing, under that Still write R. But you are not to make any Charge from any such Spirits distance.

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Rill'd, tho' it may do well to take an Account of what the Spirits come out of, and also what they go into, when distill'd. When you find them stilling Walb, put the Number of the Walb Back down in your Minute Book, and the Depth under it thus  $\frac{4}{12}$ , that is Walb came out of Number 4, and there remains 12 Inches deep in the Walb Back when the Still was charg'd or fill'd. These are inserted in the Column entitled Walb out of; and then put also, the Depth of the Walb Back down in its proper Column under Walb Back.

Of Foot Walks.

In Foot Walks they usually make four Surveys every Day, (work or not.) To each Survey you must enter the Hour, and also the Stock of the Wash Backs, and enquire what Low Wines go into it. Take the Depth, and put it under the Number it goes into, thus \(\frac{1}{2}\). So you must do every Survey; and when you find the Still off, write in that Still's Column, off.

How to cast up a Day's Work.

## How to cast up your Day's Survey.

Every Night you are to take your last Survey out of your Minute Book into your Stock Book, with the Day of the Month, Week and Hour, and the Depth of each Wash Back, and place them in their proper Columns; and also the same Letter of the Alphabet that is in your Minute Book, with the Depth of the Faints if any; and also the Depth of the Low Wines.

Now having the last Survey transcribed from your Minute Book to your Stock Book; then the next thing is to place the Wash taken out of the Minute Book in its proper Place, and multiply the Depth of Decrease of Wash by the Area of the Back it went out of; the Product is the Decrease of Wash that went out of that Back; which place in the Minute Book under Decrease of Wash, over-against the Cask it went out of. Do thus by all the Backs that Wash went out of that Day.

Then place the Number of the Casks that Low Wines came into that Day in your Minute Book. Which done, find what Low Wines came into that Cask by ullaging of it, which place in your Minute Book over-against the Cask that it went into. Do so by all the Casks that Low Wines go into that Day, and add the Increase of Low Wines, which together give you the

Day's Work.

Of charging Me- How to make your Charge of Melasses Wash.

Having cast up your Day's Work, and found the Decrease of Wash, and Increase of Low Wines, and placed them in their proper Columns in the Minute Book, and from thence transfer'd them to your Stock Book; the next Thing is:

How to the Cl

#### How to make your Charge.

How to make a

See how much one fourth of the Wash is, (which is done by multiplying it by .25). If it be less than the Increase of Low Wines, you are to put the Increase of Low Wines for the Charge, and write per Gauge in the Column your Reason for the Charge. But if \(\frac{1}{4}\) of the Wash be more than the Increase of Low Wines, then you are to charge \(\frac{1}{4}\) of Decrease of Wash for Low Wines, and \(\frac{2}{3}\) of the Wants into Spirits; that is, subtract the Increase of Low Wines from \(\frac{1}{4}\) of Decrease of Wash, and \(\frac{2}{3}\) of the Remainder is to be charg'd as Spirits.

Example. Admit the Decrease of Wash be 334.6 Gallons, An Example, and Increase of Low Wine 75.7 Gallons, now \$\frac{1}{4}\$ of 334.6 is 83.65, which I charge as Low Wines, because its more than the Increase of Low Wines: Then I subtract 75.7 from 83.6, and the Remainder is 7.95, which I put in the Minute Book in this Column Decrease of Low Wines, viz. per 7.95 whereof \$\frac{1}{3}\$ is 5.2947, but only take 5.3, which charge as Spirits.

How to make your Charge of Malt-Wash, which Of charging Male is \( \frac{1}{4} \) and \( \frac{3}{5} \).

All Denominations distilled from Malted Corn are the very fame as those distilled from Melasses. The Surveys are the same, and the casting up of the Gauges the same. Only in the Charge it disters, which is thus. If \(\frac{1}{4}\) of the Decrease of Wash, be less than the Increase of Low Wines, then you are to charge the Increase of Low Wines, and in the Reason for the Charge you are to write per Gauge: But if \(\frac{1}{4}\) of the Wash be more than the Increase of Low Wines, then the \(\frac{1}{4}\) of Decrease of Wash is to be charged into Low Wines, and \(\frac{3}{5}\) of the Wants into Spirits, and to write the Wants in the Decrease of Low Wines with per Gauge, and write in the Reason for the Charge and \(\frac{3}{5}\).

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Example. Admit the Decrease of Wash be 406 Gallons, and An Example. Increase of Low Wines 98.4, I demand from whence the Charge will arise?

The Increase of Low Wines 98.4

The Difference 3.1 called Wants.

3 equal to .6 common Multiplier.

Spirits 1.86 Gallons.

to the Charge is { 4 of Decrease of Wash as Low Wines 101.5. and 3 of the Wants as Spirits — 1.86.

Of charging Melasses Low Wines,

How to make your Charge of Melasses Low Wines.

If the  $\frac{2}{3}$  of the Decrease of Low Wines be more than the Increase of Spirits, you must charge  $\frac{2}{3}$  of the Decrease of Low Wines into Spirits, but if  $\frac{2}{3}$  of the Decrease of Low Wines be less than the Increase of Spirits, then the Increase of Spirits is to be charg'd for Spirits.

The same is to be observed in Malt, Low Wines, only instead of \(^2\) take \(^3\). This is so plain it needs no Example.

Of charging Eng- How to make a Charge of English Materials, which are \frac{1}{2} and \frac{1}{2}.

If the Increase of Low Wines be more than \frac{1}{5} of the Decrease of Wash, it's to be charg'd, and the Reason for the Charge, you are to write per Gauge; but if \frac{1}{5} of the Decrease of Wash be more than the Increase of Low Wines, then \frac{1}{5} is to be charg'd, as Low Wines, and \frac{1}{2} of the Wants into Spirits.

An Example.

Example. Admit the Increase of Low Wines be 68,7, and the Decrease of Wash 357.5. I demand from whence the Charge will arise?

The Decrease of Wash
The common Multiplier

Charg'd as Low Wines
The Increase of Low Wines

71.50

68.7

The Difference called Wants
The common Multiplier

Charg'd as Spirits

1.40

Your Charge of Low Wines is the fame as I have shewn above; only instead of  $\frac{2}{3}$  or  $\frac{3}{3}$  use  $\frac{1}{2}$ : Then work as before.

I shall close this Chapter with the DISTILLERS CASE.

The Case of the MALT DISTILLERS in and about The Malt Distil-London, as it was humbly offer'd to the Con-ler's Case. sideration of Parliament, in the Year 1736.

E beg Leave humbly to represent, that should the Bill now depending (calculated for preventing the excessive Drinking of Spirituous Liquors, &c.) pass into a Law, agreeably to the late Resolutions of the House of Commons, an absolute and entire Probibition of the Malt Distilling Trade must be the necessary and immediate Consequence; it being impossible that there should be any Consumption of that Kind of Spirits, under the Restrictions pro-

pos'd.

The Malt Distillers acknowledge, and have for some 'Time reflected with the deepest Concern, on those horrid Abuses which have been made of Spirituous Liquors, by ' the excessive Drinking of them among the common People, ' and would heartily concur in any Methods, which might be propos'd for the preventing such Irregularities. They ' hoped indeed, that the defirable Purpose of Reformation might have been effected by some Methods less severe than the total Extirpation of so considerable a Branch of our own Manufacture, on which fo many Thousands of Families ' depend, and in which, as we apprehend, the Landed Interest likewise must be very nearly concern'd. But if the Evil from thence arising, is so great, so epidemical, that ' the Publick is endanger'd by it; and fince it can by no other Methods be eradicated—the Malt Distillery doubtless ought to fall a Sacrifice.

But we humbly hope, that the Malt Diftillers, deserve fome Regard and Compassion, who are so far from having done any Thing to render themselves obnoxious to the Censures of this Honourable House, that they have, on the contrary, acted all along under their Sanction and Encouragement: It was on this Foundation that they erected their Houses, and trusted out their Fortunes, and they imagined that they had not only a just and legal, but an

unshaken Security.

But should this Bill take place, in the Shape it now appears, hard and terrible must be their Fate. They will not only be deprived of their Trade, and put beyond all Possibility of Increasing their Fortunes, but what infinitely heightens the Calamity, even what they have already acquir'd must then be rendered exceeding hazardous and precarious.

There will be no Possibility for them (but with the greatest Disadvantage) to get rid of their Stocks of Corn, of Hogs, of Spirits, to collect their Debts, to dispose of their Houses,

- or to fulfil their Contracts. In short, such a total, such an ' immediate Stagnation in Trade, must be attended with the
- · Ruin of almost every one concerned in it.
- It is our greatest Consolation, under the present Di-· lemma, that we are in the Hands of a British Parliament,
- ' who are the tenderest Guardians of the Liberties of the
- Subject; who we doubt not but will compaffionate our
- ' Case, and in their great Humanity and Wisdom accept of ' fome Methods for our Preservation: That tho' we are to
- remain no longer as a Trade, yet at least they would be
- pleased to allow us such a Portion of Time, under such a
- Limitation of Work, as we were restrained to by an Act
- of Parliament made in the 10th and 11th of K. William III. by which means the dreadful Confequences before-men-
- ' tioned may in some Measure be avoided.'

Note. The Ast of Parliament, to which the above Cafe relates, took place the 29th of September, 1736.

#### CHAP. XXX.

Tables of the Measure of Exciseable Liquors.

What Liquors are IN E. measured by the Wine Gallon ?



Cyder, Perry, Verjuice,

63 Gallons to the Hogshead, each Gallon containing 231 Cubic Inches

Mead. Wash. Low Wines. Spirits, Brandy.

are charged by the Wine Gallon.

Sweets 31 1 Gallons to the Barrel, Wine Measure.

#### In the COUNTRY.

Beer, Ale, Beer, and Vinegar in the Ale, Country. Vinegar,

34 Gallons to the Barrel, each containing 282 Cubic Inches.

Ale, Beer, and Vimezar in London.

In LONDON.

367 Beer is Ale is Vinegar 314

Gallons to the Barrel, each Gallon contains ing 282 Cubic Inches.

ATA-

## Chap. XXX. Of wine Bealure.

ie Mealure.	16	3
Ton Butt Punchion Hoghead Tierce Barrel Rundlet Gallon * Quart Pint	Names.	
are		
2042: 9: 4 1021: 4: 10 680: 13: 12 510: 10: 5 340: 6: 14 251: 6: 10 145: 14: 6 145: 14: 6 145: 14: 6 145: 14: 6 145: 14: 6 15: 0: 63 2: 0: 63 1: 0: 3.375	Averdupois Weight. Cubick  lb. oz. dr. Inches.	A I ABLE of WINE-MEASURE
\$8212 2016 29106 1008 19404 672 14553 504 9702 336 7276.5 252 4158 144 231 8 573 2 28.875 1	Cubick Pints	I to of WI
12522	Quarts.	NE-N
1 3 4 5 8 6 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Gall-Ru	EASU
1 1 2 4 8 8 1 3 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	nd. Barr	F
1-1000	Tierce	
4 3 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Hog. Punch	
5	n. Butt. I	
Allons.	BEE	R

all then present were fully satisfied the Wine Gallon doth contain but 224 Cubic Inches, (this notable Experiment I saw tried Perry, Cyder, Vinegar, Oyl and Honey, &c. are measur'd and fold, is suppos'd to contain 231 Cubick Inches: But Dr W. (May 25, 1688.) before the Lord-Mayor, the Commissioners of Excise, the Rev. Mr Flamstead, Astron. Reg. Mr Halley, and several other Ingenious Gentlemen, in whose Presence Mr Shales did exactly fill the aforesaid Brazen Vessel with clean and its Depth 14 Inches, fo that its just Content was 224 Cubic Inches. This Vessel was produced at Guildball in the Excise: They caus'd a Vessel to be made of Brass in the Form of a Parallelepipedon, each Side of its Base was a Inches, bard in his Tectometry, page 289, doth suppose the Wine Gallon to contain but 224 or 225 Cubic Inches at the most, and pursuant to this Account, an Experiment was made by Mr Richard Walker and Mr Philip Shales, two General Officers in Water, and very carefully emptied it into the old Standard Wine Gallon kept in Guildball, which did so exactly fill it, that Inches to be the Wine Gallon, and that all Computations in gauging shou'd be made from thence as above. However for several Reasons it was at that Time thought convenient to continue the former supposed Content of 231 Cubi London

Ward's Mathematicks, Page 34.

BEER-MEASURE, for London, is 36 Gallons to the Barrel.

	Names.		Cubick Inches.	Pints	Quarts.	Gall.	Fir.	Kil.	Bar.	Hog.	Butt.	Ton.
Ina	Ton Butt Hogshead Barrel Kilderkin Firkin Gallon Quart Pint	are \	50912 30456 15228 10152 5076 2538 282 70½ 35¼	1728 864 432 288 144 72 8 2	72 36	216 108 54 36 18 9	24 12 6 4 2 1	12 6 3 2 1	6 3 1 1 2 1	4 2 1	2 1	1

ALE-MEASURE, for London, is 32 Gallons to the Barrel.

Names.	Cubick Inches.	Pints.	Quarts.	Gall.	Fir.	Kil.	Bar.	Hog
In a { Hogshead Barrel Kilderkin Firkin Gallon Quart Pint	13536 9024 4512 2256 282 701/2 351/4	384 256 128 64 8 2	192 128 64 32 4	48 32 16 8	6 4 2 1	3 2 1	1 ½ 1	-

BEER and ALE MEASURE, for the Country, is 34 Gallons \* to the Barrel.

Names.	Cubick Inches.	Pints.	Quarts.	Gall.	Fir.	Kil.	Bar.	Hog
Hogshead Barrel Kilderkin In a Firkin Gallon Quart Pint	14382 9588 4794 2397 282 7012 3514	408 272 136 68 8 2	204 136 68 34 4	51 34 17 81 1	6 4 2 1	3 2 1	[ 1 2 ]	<u>:</u>

And as One Pound Troy is in Proportion to the Cubick Inches in a Wine Gallon, fo is One Pound Averdupoise to the Cubick Inches in an Ale Gallon, that is, 12:231: 14 ½ : 281½ very near the Cubick Inches contained in an Ale Gallon, as appears from an Experiment made by one Nicholas Gunton, General Gauger in the Excise, about 44 Years ago, who by such a Vessel mention'd before in the last Page did find the Standard Ale Quart, kept in the Exchequer, (vide 12 Car. II.) to contain 70½ Cubic Inches; consequently the Ale Gallon must contain 282 Cubic Inches, and from thence these three Tables are computed.

Ward's Mathematicks, pag. 35.

C H A P.

#### CHAP. XXXI.

I.

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35. P. The RATES of Exciseable Liquors, and other DUTIES under the Management of the Honourable Commissioners of EXCISE.

			59 6	
TRONG Beer per Barrel	- 0	5	O Strong Be	er.
Small Beer per Barrel.	- 0	I	4 Small Re	
Cyder and Perry per Hog shead.	-0			Perr
Verjuice, per Hogshead.— Mead or Metheglin, per Gallon.	- 0	6	8 Verjuice.	
Spirits or Strong Waters, per Gallon.	_ 0	0	I Mead.	
N.B. ' There is a Duty of 20 s. chargeable u			3 Spirits, &	•
' lon of distill'd Spirituous Liquors found of any Retailer thereof.'	in the	Poffe	Jion	
Sweets by 5 Anne, from 24. March, 1706, for 99 Years, for every Barrel	} i	16	o Sweets.	
Note. 'The Duty of 36 s. per Barrel for all distinguished in the Acts of Parliament of Sweets, is repealed, and in Lieu there chargeable with a Duty of 12 s. per Bar by the Maker.	by the	be No	ame ome	
Vinegar, &c. by 10. Will. III. per Barrel- Low Wines from Foreign Materials, or any		8	9 Vinegar.	
Mixture therewith, per Gallon	0	0	4 7	1 100
From 24. March, 1705, for 5 Years, more	1 .	0	2 Low W	ines.
Low Wines from Wash, made of Malt or Corn,	}			
except Brewers Wash and Tilts, per Gallon.	0	0	I Ditto.	
Low Wines from Brewers Wash or Tilts, or	1			
any Mixture therewith, per Gallon	0	0	I Ditto.	1
Low Wines from any other English Materials or any other Mixture therewith, per Gallon.	0	0	1 Ditto.	
The five last Duties on Low Wines are continu	ued by	the	ad .	
and 4th of Anne, from March 24. 1706, to Ja				
and from thence by 5 Anne for 96 Years.				
0 " 0				
Candles, Soap, and Starch.				
l. s. d.				

	1. s. a.	
Candles, Tallow	(001)	See Part II. p. 30, Candles
Candles, Wax	008	See Part II. p. 30. Soap. See P. II. p. 38,&c. Starch,
Soap - Per	10una. 00 11	See Part II. p. 30. Soap.
Starch -	002	See P. II. p.38, &c. Starch,
	M 3	Silks,

cuvic	Triduntas	ccc.	1 41	r T
C . 77	0 -			

From

	Silks, &c.
Silks, Linen, and Stuffs.	Printed Silks, \(\frac{1}{2}\) Yard wide per Yard \(\circ\) 1 \(\circ\) Silk Handkerchiefs Callicoes Linen and Stuffs \(-\)  Yard wide per Yard. \(\begin{array}{c} 1 & 3 & d \\ 0 & 1 & 0 \\ 0 & 0 & 4 \\ 0 & 0 & 6 \\ 0 & 0 & 3 \end{array}\) See Part II. Page 48.
	Coffee, Tea, and Chocolate.
Coffee, Tea, and Chocolate.	Coffee } per Pound.
	Wrought Plate, &c.
Plate, Silver Wire and Gilt Wire.	Wrought Plate————————————————————————————————————
Papers. Leather, &c.	For PAPERS of all Sorts, see Part II. Page 45, &c. For Tanners, Tawers, Oil-Dressers, and Parchment-Makers Goods, see Part II. Page 29.
	The Excise on Liquors Imported.
	* This Duty; both in England and Scotland, is under the Management of the Commissioners of the Excise respec- tively, who generally impower the Collectors of the Customs at the several Ports to levy it for them; being payable on the following Liquors, viz.
From Foreign	From Foreign Parts.
Ale, &c.	
Mum, Cyder, &c.	Mum, the Barrel 1 5 0 Cyder or Perry, the Tun 12 10 0
Brandy, &c.	Brandy, Aqua Vitæ, Spirits, or Strong Waters } 0 4 8
Ditto Double.	Brandy, &c. as before being Double, or above Proof, per Gallon
From British Plantations in America.	N.B. Brandy, Aqua Vitæ, Spirits, or Strong Waters from the British Plantations in America, being Single, per Gallon— Ditto, being Double or above Proof, per Gallon—  0 6 8
	Not to be Landed, before due Entry be made with the Col- lector of Excise at the Port of Importation, or before the Excise be fully satisfied and paid, and a Warrant for the Landing or Delivering signed by the said Collector, or without the Presence of the Excise Officer, upon Forfeiture, or the Value.

From Guernsey, Jersey, Sark, or Alderney.	5.	d.	From Guernzsy, &cc.
Brandy, Aqua Vitæ, Strong Waters or Spirits	8		Brandy, &c.
Vinegar per Barrel—	8	9	Vinegar.
Cyder or Perry per Hoglhead——— o		8	Cyder, &c.
Beer, Ale and Mum per Barrel			Ale, &c.
All other Exciseable Liquors the same Duties as pair		his	
Kingdom.			
Before the Landing of any Liquors from Guernsey,	Jerf	ey,	
' &c. Oath must be made by the Importer be	fore	the	
" Collector of the Customs, that they are of the			
and Manufacture of the faid Islands, and n			
from, or mixed with any Foreign Liquors,			

#### CHAP. XXXII.

N.B. Upon Exportation of any of the above Liquors there

How to measure the different Gravity of L1-QUORS, which shews the different Strengths thereof: Also a TABLE of Specific Gravity.

See Plate 1. Fig. A.

HERE is an Instrument, made of Glass, or Of the Areometer Ivory, &c. about 3 to 1 Inches long, called and its Use, an AREOMETER, there being as much Quicksilver in the Bottom at B, as will serve to keep it swimming in an erect Position. The

is no Drawback.

7\_

Stem is divided into Degrees, and by the Depth of its Descent into any Liquor, its Lightness is concluded: For that Fluid or Liquor, in which it finks leaft, must be heaviest : For the greater the Gravity the stronger the Liquor, and the less the Gravity the smaller the Liquor. You may make one for common Use of any Wood, about 3 of an Inch Diameter at the Bottom, and terminating in a Conical Point at the Top, putting as much Lead in the Bottom as will keep it upright, when in the Liquor.

#### ATABLE of Specific Gravity, an Ounce the Integer.

	Name.	Ounces and Decimal Parts Troy.		Troy Pw	7	Ounces and Decimal Pts. Averdupoife.	Ave	rdup.
One Cubic Inch of	Fine Gold, is— Standard Gold— Quickfilver— Lead— Fine Silver— Standard Silver— Rofe Copper— Plate Brafs— Caft Brafs— Steel— Common Iron— Block Tin— Fine Marble— Common Glafs— Alabafter Dry Ivory London Brew'd Ale— Dry Box-Wood— Beer Vinegar— Sack— Milk— Urine— College Plain Ale— Sea Water, clear— Pump Water— Claret— Lin-feed Oyl— Proof Spirits, Brandy Sound Dry Oak— Oyl Olive— Oyl of Turpentine— Half a Pint of Muf- tard Seed weighs	10.359273 9.962625 7.384411 5.984010 5.850035 5.556769 4.747121 4.404273 4.272409 4.142127 4.031361 3.861519 1.429411 1.360841 0.988456 0.962083 0.562786 0.543282 0.543282 0.544864 0.543809 0.543282 0.542227 0.542227 0.542742 0.523766 0.491591 0.489268 0.481569 0.383680	10 9 7 5 5 5 4 4 4 4 4 4 3 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	7 19 7 19 17 11 14 8 5 2 0 17 8 7 19 11 10 10 10 10 10 10 10 10 10 10 10 10	4666033231188156666212222112013111200191516	11.365602 10.930422 8.101753 6.553885 6.418324 6.096569 5.208369 4.832116 4.630300 4.544505 4.422979 4.236638 1.568859 1.493037 1.084477 1.055542 0.69929 0.596057 0.591070 0.596057 0.591070 0.596057 0.594894 0.578697 0.574646 0.539345 0.536569 0.528350 0.415820	11 10 8 6 6 6 6 5 4 4 4 4 4 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0	5.8 10.9 6.7 1.4 3.3 10.1 6.8 9.3 7.9 10.9 9.5 9.5 9.4 9.4 9.4 9.4 9.4 9.4 9.4 9.4 9.4 9.4

The Weight of a Cubic Foot of several Bodies, Averdupoise Table of a Cubic Weight, in Pounds and Decimal Parts, &c. Foot.

	16.	16.	02.	dr.
Gravel Common Sand Newcastle Coal Pump Water Wood Ashes Bay Salt White Pease Field Beans Wheat, of the best Sort White Sea Salt Barley Wheaten and Meal unsisted Malt, two Months old White Oats	109.3125 85.25 67.75 62.7734375 58.3125 54.0625 50.5 48.5 43.75 41.125 31. 30.25 29.5	109 85 67	5 4 12 12 5 1 8 8 8 12 2 0 4 8	6.4
Rye Meal unfifted		29		0

The Use of the Tables of Specific GRAVITY:

Use of the Tables.

These Tables are of excellent Use; for, by knowing the folid Inches or Feet, we can tell the Weight; or, by having the Weight, we can tell how many folid Feet or Inches are contained in any Quantity, &c.

Example. There is a Bar of Iron, in Length 156 Inches, Example 1. and 1 Inch square; I desire to know how many Pounds Averdupoise doth it weigh?

Operation.

Operation,

The Value of this Fraction .12404525 lb. is 1. Ounce, and .984724 Parts of an Ounce. So that the Iron weighed 43 lb. 1.984724 oz.

Again ;

Part I.

Example 2.

Again; Suppose a Bar of Iron weigh 43 lb. 1.984724 oz. I demand how many folid Feet it contains?

This is but the Reverse of the former Question ; for fay.

As 4.422979 Ounces give one Inch, what will 43 lb. 1.984724 Ounces give ?

Work by the Single Rule of Three direct, as is taught in Page 20, and the Answer will come out .0902 Decimal Parts of a Solid Foot.

Operation.

See the Work.

Inch. 16. 02. As 4.422979 is to 1, So is 43 1.984724

259 43

1728)

4.422979)689.984724(1560000(.0902

That is fomething less than half a Quarter of a Foot.

It is a common received Opinion amongst Distillers, that A Tun of Brandy four Hogsbeads, or one Tun, (equal to 252 Gallons) of Brandy 2000 lb. Weight. weighs 2000 lb. Weight Averdupoife; how this agrees with our Table we will thus examine.

> First. In one Gallon there are 231 Cubic Inches, which multiplied by 252 Gallons, produceth 58212 Cubic Inches in a Tun, which multiply by .536796 (the Tabular Number of one Inch of Proof Spirits Averdupoise) produces 31247.968752 Ounces, which divided by 16 (the Ounces in a Pound) the Quotient is 1952.998047 Pounds, which you fee is something less than 2000; but then, by allowing the Difference for the Tare, or Weight of the Cask when Empty, their Number 2000 is pretty near the Truth.

To prevent Impo-Øc.

Hence also you may most accurately discover whether you fitions by Vint- are imposed upon by the Merchant, Vintner, or Distiller, &c. ners, Distillers, in Quantities of Wine or Spirits, which you have bought on in Quantities of Wine or Spirits, which you have bought on the Credit of the Sample that was shew'd you to examine; for, if you find that the Specific Gravity of the whole Vessel fent you home is different from that Parcel which you tried. you may be affured it is some way mixt and adulterated.

Example 3.

Example 3. What's the Weight of a Barrel of London Brew'd ALE which contains 32 Gallons?

> Gall. Inch. Gall. Inch. First, fay, If 1 : 282 :: 32 : 9024

Again,

Inch. Ounces. Inch. Again, say, If 1: .609929:: 9024: 5503.999296. which divided by 16, gives Pounds 343.999956 for Anfwer.

Example 4. What's the Weight of a Bushel of Wheat? Example 4.

Inches. Pounds. Inches. Pounds. As 1728 is to 48.5 fo is 2150.44 to 60.356 for Answer.

Note. If you would find what Weight any Quantity of A Note. these Bodies mentioned in the Table will have when immerfed or put into Water, you must fubtract the Weight of an equal Quantity of Water, from the Weight of the proposed Body (if it be beavier than Water) and there will remain the Weight required. As for Instance.

A Cubic Inch of Common Iron is = 4.422979 A Cubic Inch of Pump Water is = 0.578697

Remains 3.844282 The Weight of a Cubic Inch of Iron in Water.

#### C H A P. XXXIII.

Of CORD-WOOD\*. See Plate 4. Fig. 10.

Of Cordwood.

ORD-WOOD is mostly used in such Countries where Iron Forges are; I have often obferved in Worcestershire, in my Lord Phymouth's Woods, &c. the Manner of Cutting and Burning the Cord-Wood, which is thus:

In October they begin to fell the Old Hedge Dwarf-Oak, When felled, &c. and other Brambles, which they faw, or cut into three Foot Lengths; and if the Thickness will bear it, they cleave it in small Pieces with a Wedge, about two or three Inches thick. Then they pile it up in Ranks, and let them stand thus 'till March following. Having lain all Winter in these Piles or Ranks to dry, the Workmen (or rather Colliers, as they call them) take them down, and build them all up again very curiously, laying every Piece so close and even, that you cannot see between one Piece and another, and the Ends are all exceeding even: The Ends of the Ranks are supported by Stakes driven into the Ground. They having thus re-built

\* This Rank of Cord-Wood is not laid down in a due Proportion by a Scale, as most of the Figures in the Book are; because the Room we are confined to will not admit of it. CF is a Cord, or Rope, tied to two Stakes at each End of the Rank, by which it is sup-

ported from falling.

all the Piles or Ranks, they are now ready for the Measurer: for this Sort of Wood is always fold by the Cord; the Dimensions of which are eight Feet long, four Feet high, and four Feet broad. And this is called a Statute Cord, whose The Customs in Solidity is 128 Feet for a Divisor: But different Counties different Coun- have different Customs, as we are informed by one \* who hath been employed many Years in these Affairs. He says, that in Denbighsbire, Flintsbire, Chesbire, and the adjoining Part of Shropsbire, they cut the Wood three Feet, and fet up with a Facing to be four feet wide or broad, and four Feet high, and eight Feet long; in the other Part of Shropshire, some Part of Staffordshire, Worcestershire, and Montgomeryshire, they cut their Wood three Feet long, and fet it up three Feet wide, four Feet high, and then they allow the Buyer four Cord for three or ten Feet and eight Inches in Length for a Cord.

I have feen (fays he) in fome Places Wood cut two Feet, and fet up a Foot wide, and four Feet high; then two Cord (as they call it) or fixteen Feet in Length is a Cord: But here in Suffex they differ from all the above-mention'd. The Wood is cut three Feet, and is fet up three Feet wide, and three Feet high, and they call fourteen Feet in Length a Cord, which is less by two Feet than the other, it being only 126; for,

 $3 \times 3 = 9 \times 14 = 126$ .

And I understand this Sort of Cord is used in most Parts of the South of England, both for Iron Works, and for the Fire in private Ule.

An Example,

Example. Admit a Pile or Rank of Cord-Wood be 14 Feet long, 4 Feet bigh, and 4 Feet broad; how many Cords are therein?

4X4=16X14=224 divided by 128=1.77 Cord, for Answer.

By the Sliding Rule.

By the Sliding Rule.

First. You must find a Gauge-Point for this Purpose, which is no more than the Square-Root of 128, which is 11.31; but by making use of this first Gauge-Point, the Work will fall off the Rule: Therefore the second Gauge-Point I find to be 35.7, as is taught in Page 49.

Secondly. The Mean between the Length of the Rank A B 14, and the Breadth AD 4, is 7.5; Now fay,

> As 35.7 is to 4 So is 7.5 to 1.77 Gauge Pt. Depth. Mean. Content.

Example 2.

Example 2. Admit a Rank of Cord-Wood AB = CF, be 20 Feet long, 4 Feet broad, and A E 5 Feet deep, how many Cords are there in the Rank?

Operation.

Mr. Davies, Agent to Madam Crawley's Works in Suffex.

Operation.

Operation.

First, for the Mean between AB 20, and AD 4. C. C. As 20 is to 20. fo is 4 to 8.94 the Mean.

Secondly, for the Content by the second Gauge Point.

As 35.7 is to 5, fo is 8.94 to 3.13. Gauge Pt. Depth. Mean. Content.

#### CHAP. XXXIV.

To measure MARL-PITS.

Of measuring Marl-Pits.

N Lancasbire and the adjacent Counties this Sort Marling as pracof Measuring is of great Use, for when their Land tifed in Lancahas been graffed fo long 'till it begins to bring shire. forth Rushes, Moss, &c. then they propose to marl, which they generally do in May or June, that so they may have finished before their Hay Harvest in

that County begins.

When the Owner of the Land has proposed how many Acres he defigns to marl, he appoints 10 or 12 Labouring Men (called Marlers) to come and view the fame; which done, they agree upon a Price, which is about 20 s. a Rod, Price per Rood. or Rood, that is for fo many Rods of Marl that are contain'd in the Pit. (They have eight Yards in Length to the Rood, which makes their Acre and Measures depending thereon very large.) The Marlers having agreed with the Owner for a Price, and Place where the Pit must be, they come in the Winter and Fey, (as they call it) that is, mark out the Shape of the Pit, and dig off the Earth 'till they come to the Marl, which much resembles a kind of fat straiked Clay; this in fome Lands lieth near the Surface of the Earth, and in other a Foot or two deep, more or less according to the Nature and Goodness of the Land. The Carts which are made use of in this Work are (or ought to be) , Feet long, 2.7 Feet wide Size of the Carts. within over the Axle-Tree, and 2 Feet deep, fo that a Cart of these Dimensions will just hold 27 solid Feet of Marl, and is accounted one Load, always drawn with two Horses from the Pit to the Field: The Marlers Day-work is fo many Thousand Load according to the Number of Hands employ'd. They begin in the Morning at three o'Clock or before, and leave Work Hours of Workabout three in the Afternoon.

They

Marl a lafting Manure.

They have two Men in the Pit called Feyers, and the rest are Fillers; and in the Field there is a Man (or two if the Work is large) called a Setter, that is, directs the Driver of the Cart where to empty his Load, and there the Setter spreads the Marl thin upon the Ground; and thus it lieth 'till the next Spring, and then they plow it up, and fow it with Oats. This way of manuring the Land is counted the best, because it will endure many Years without any other Repair. But fuch Marl, as is in Lancasbire, is not to be found in every County in England; for in Worcestersbire, Warwicksbire, &c. they manure their Land with Lime, fetched in Waggons from the Lime Pits. This they spread over the Land, but this will not last above two or three Years.

Lime not fo.

Ceremony of dreffing the Pit.

When the Marlers have finished, they set a Day apart to dress the Pitt, which they do with Flowers, and the Drivers and Horses are dreft with Posses or Nosegays, at which Time there is a good Feast provided, with a fine Poste or Garland, drest with Plate, Rings, Watches, &c. (after the manner of Milk-maids on a May-day in London) prepared by some of the Country-maids, which they bring to the Pitt, and present it to the young Man that drives the Master's Team, he having the honour all that Day to hold the Pose (as they call it) or Garland, which is reckoned amongst them a very great Piece of Honour.

Of measuring the Pit.

Sometime after this, the Master and Workmen agree to make choice of some able Artist to measure the Pit, which is done in the following manner.

#### See Plate 4. Fig. 11.

What a Rood of Marl.

First. You are to observe that 8 Yards long, 8 Yards broad, and i Yard deep is a Rood of Marl in Lancasbire: Therefore the Dimensions being taken in Feet and Decimal Parts of a Foot is a Divisor for Roods will be 1728 Feet, for 8 x 8 = 64×9=576×3=1728 Feet.

Thus, having found the Divisor for a Rood of Marl, where 8 Yards in Length is one Rood, the next Thing in order is to shew how to take the Dimensions, which you may do in this

Form of the Pit Paper.

Come to the Pit, draw the Form of it upon Paper, and dito be drawn on vide its Surface into Trapeziums and Triangles; having provided some good Pack-thread, do the like by the Pit itself, and measure the Bases and Perpendiculars in Feet and Decimal Parts, and in the most convenient Places (as your own Judgment will best direct) of the Pit. Take the Depths in the like Measure, and set them down upon your Paper Draught, as you see done in the Figure. Having taken the Dimensions as above directed, we shall next proceed to cast up the Content thereof.

CE

```
Depths.
               CE=42.5
                                      16.8
              1 DI= 2
                                      15.8
         The Area = 85.0
                              The Sum 32.6
                             The half 16.3
                             The Area 85
                                       815
                                     1304
             The Content of CDEI=1385.5
                                        Depths.
                   AC=51.5
BK= 2.6
                                         15.8
                                          5.0
                                          2.I
                         3090
                        1030
                                       3)22.9(7.6
               The Area 133.90
               The Depth 7.6
                         8034
                       9373
The Content of ABCK=1017.64 Feet.
AE=70
                CH=30.5
                                  Depths.
                 GF=35.5
                                    16.8
                                    15.8
             The Sum
                      66.0
                                    14.7
         Half the Sum
                                    11.3
                     33.0
              AE=
                                    10.6
                       70
                                     9.4
          The Area 2310 .
                                     8.7
         The Depth
                    .10.3
                                     3.4
                                     2.I
                     6930
                                  9)92.8(10.3 Equated
                   2310
The Content ACEF=23793.0 } Feet.
                                             Depth.
         CDEI= 1385.5
        ABCK= 1017.64
             1728) 26196.14 ($5.17 Rods.
                            64
                                       Roods. Yards.
                             68
                                  Anfw. 15 10.88
                           102
                          10:88
                                              Notes
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Part I.

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4 Kai NRth

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A Note.

Note. The two Depths, next to the Pace of the Pit, are not taken in whole, but in their Halves, to answer the Shallowness of that Part of the Pit.

By the Sliding Rule. By the Sliding Rule.

The Divisor for reducing of Feet into Rods is 1728, its Square Root is 41.6 the Gauge Point on the Sliding Rule.

1. For the Triangle CDEI: The Mean between CE 42.5 and half DI z is 9.22, See Page 43, and the mean Depth is 16.3 Feet.

D. C. D. C.
As 41.6 is to 16.3, so is 9.22 to .80 Rod or Roods.
Gauge Pt. Depth. Mean. Content.

2. For the Content of the Triangle ABCK.

The Mean between AC 51.5, and half BK 2.6 = 11.57, and the mean Depth 7.6 Feet.

D. C. D. C.
As 41.6 is to 7.6, so is 11.57 to .59 Rods or Roods.
Gauge Pt. Depth. Mean. Content.

3. For the Trapezium ACEF; the half of the two Perpendiculars is 33, and the equated Depth 10.3 Feet, and the Mean between the Base AE 70, and half Sum of the Perpendiculars 33, is 48.06.

D. C. D. C.
As 41.6 is to 10.3, so is 48.06 to 13.7 Rods or Roods.
Gauge Pt. Depth. Mean. Content.

ACEF=13.7 ABCK= .59 CDEI= .80

The rubole Content of the Pit= 15.09 Rods, as above.

A Note.

Note. In the fecond Work, where the Diagonals are taken in Rods, and the Depth in Yards, if you find the Area of each Triangle, &c. (according to the Rules of measuring Superficies) and those Area's multiplied by the Depths on the Lines A and B on the Sliding Rule, you will have the Content in Rods as above, which being so plain needs no Example.

If we reduce the Bases and Perpendiculars into Rods (or Roods) of eight Yards to the Rod, and the Depths into Yards and Decimal Parts, they will stand thus.

Depths.

Depths.		Diagonals.	
Feet.	Yards.	Feet.	Rods.
15.8 16.8 11.4 14.7 10.6 8.7 9.4 5.0 2.1	5.27 5.6 3.76 4.89 3.53 2.89 3.169 1.66 0.69	C F = 42.5 D I = 4. AC = 51.5 B K = 5.2 A E = 70. C H = 30.5 G E = 35.5	1.77 .166 2.146 .219 2.92 1.27 1.46

They are reduced thus, viz. 16 Feet are 5 1 Yards, and .8 of a Foot is \frac{3}{10} of \frac{1}{3} of a Yard, which two Fractions, Viz. \frac{1}{3} and  $\frac{8}{10}$  of  $\frac{1}{3}$  will be  $\frac{54}{50}$  its Decimal = .6 of a Yard. Then 42.5 Feet, is  $1.\frac{3}{4}$  Rod, and .5 of a Foot is  $\frac{5}{10}$  of  $\frac{1}{3}$  of  $\frac{1}{8}$  of a Rod,  $=\frac{5}{240}$  and  $\frac{3}{4}=\frac{740}{500}$ , its Decimal is .7708 of a Rod, and after this manner I have reduced the other Feet in the Table. Now if the Superficial Content of each Triangle be found in Rods, and that multiplied by the Depth in Yards, it will give the Content of the Pit as before, and the Fractional Part of a Rod multiplied by 64, gives its Value in Yards.

For this purpose, it will do well for the Practitioner to have Chains, of what a Chain eight Yards long, Decimally divided; but if he mea-Length, fures where 5 \(\frac{1}{2}\)Yards make a Rood or Perch, then let his Chain be that Length; also he must have a Yard Decimally A Decimal Yard. divided to take the several Depths, as has been above directed.

#### CHAP. XXXV.

Shewing bow to find the exact Distance to any Objest that's visible, without an Instrument, or ACTUALLY MEASURING of the Distance that is required.

See Plate 4. Fig. 12.

HERE are many good Ways known to Geome-Several Methods tricians to take the Distance of Places one from of taking Distananother, or, from your Station to any Place feen ces. at a Distance; but withall, there must then be an Instrument used to take Angles, at two Stations, and oftentimes Trigonometry is called in to their Assist-

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ance, my Bufiness shall be here to shew how to perform the same without an Instrument.

#### EXAMPLE:

Get four fireight Sticks, (it matters not whether they be all of a Length or not,) and then let it be required to measure the Distance AB, upon some plain level Ground : At A thrust down one of the Sticks, there stand, and order an Affistant to thrust another down at C, so that standing at A you may see the Staff C, and the Mark at B, both in a right Line; (now it matters not at what Distance the Staff A, is from the Staff C, but if your Distance required be large, then the farther C, is from A the better: ) Then take a third Staff, and go from C. any Number of Feet, Yards, or any other Measure to D, so that the Line CD may be at right Angles with AB, and at D, thrust down the third Staff: Lastly, take the other Staff, and go from A, (Square-wife as before) fo far 'till you can fee the Staff D, and the Mark B in a right Line, which I suppose here to be at F, here make a Mark, and measure the Distance FE 25 Feet, &c. and EA 39.1, then FE 25 added to EA 39.1, make FA 64.1 Feet, by measuring CD equal to AE, I find it to be 39.1. Now the Truth of this Performance is grounded upon fimilar Triangles, for the Triangle FED is fimilar to the Triangle FAB. Therefore it will always hold.

As FE 2 1 to ED 39, fo is FA 64.1 to AB 100 feré.

Operation.

As 25 is to 39, fo is 64.1

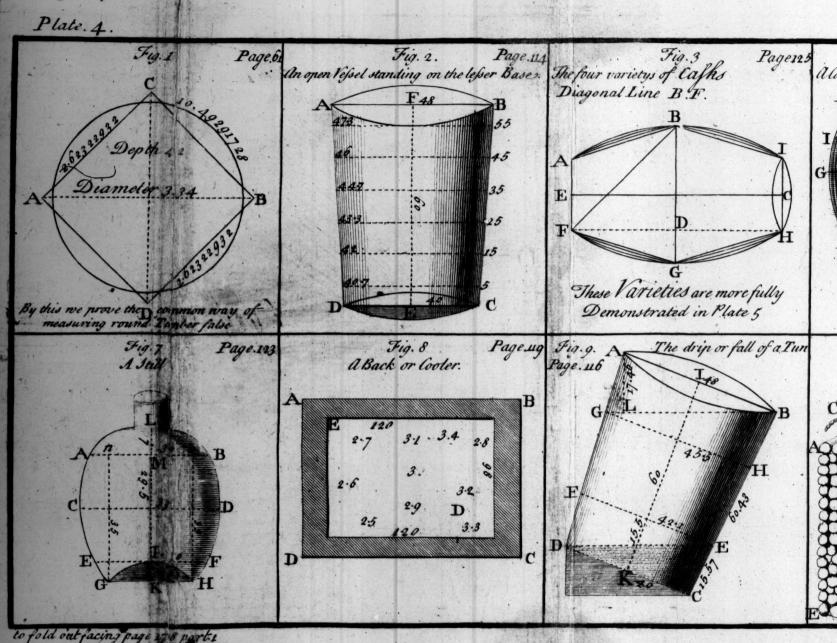
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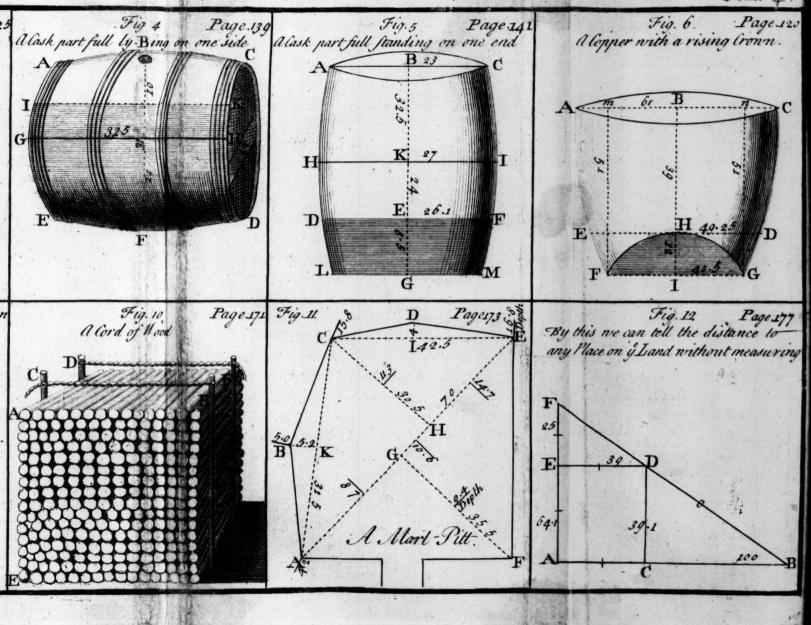
25)24999(100 feré.

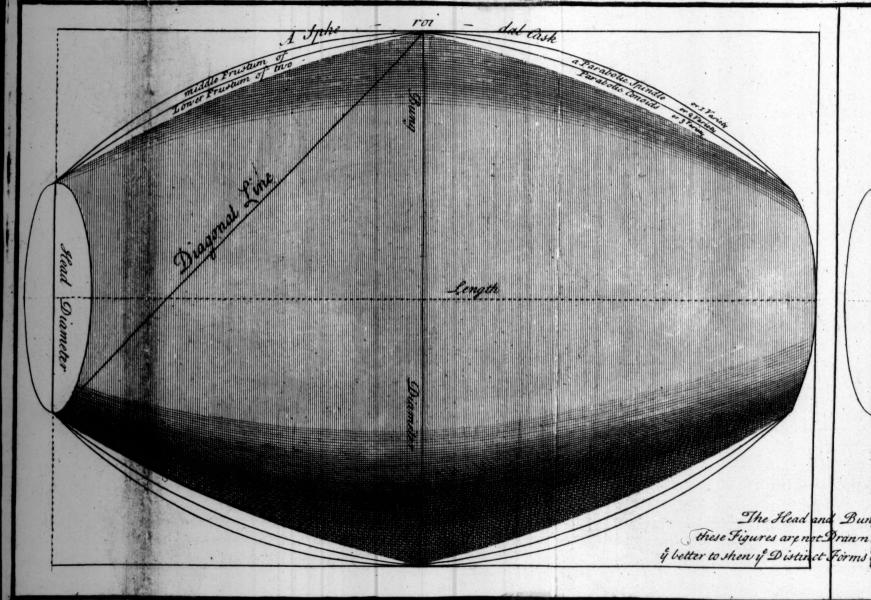
Note. It matters not whether ACDE be a Square, or an Oblong, provided always the Angles be right.

The End of the FIRST PART.

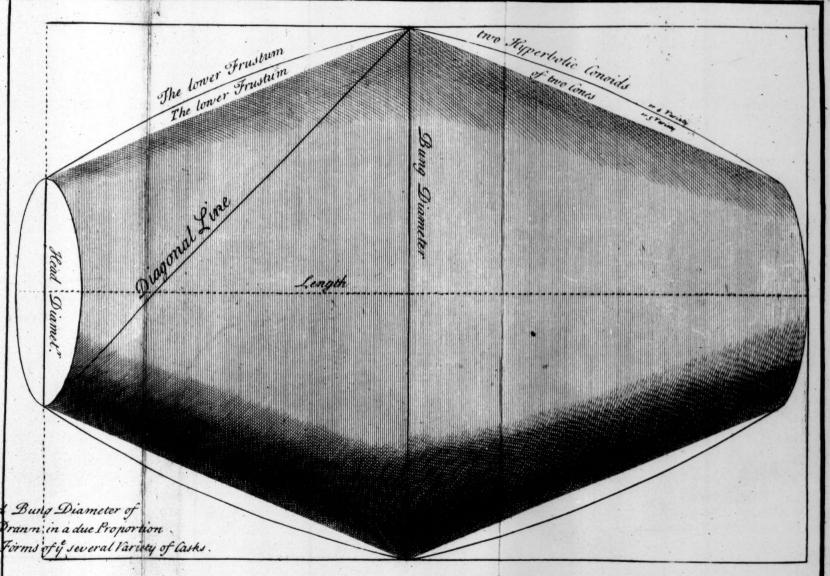








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#### THE

# Royal Gauger.

# PART

#### CHAP.

Shewing what is to be observed and done by those who would qualify themselves for the Employment of an Officer in the Excise; together with the Forms of those Oaths, Certificates, &c. which are necessary for that Purpose.



HE Method of obtaining Employment in the Excife is, by petitioning the Commissioners for an Order to be instructed; and in order to that, the Person who would petition must procure from the Minister of the Parish where he was born a Cer-

tificate of his Age, which must not be less than 24,\* nor more \* See the Collecthan 30; and if married he must have no more than two tors Duty on p. 3. Children.

#### A Certificate of the Petitioner's Age.

HESE are humbly to certify the Honourable Commissioners Certificate of the of Excise, and whom it may concern, that C. L. of F. in Petitioner's Age, Years old, as I find it in the Register of Register.

aforesaid. In Tea: the County of L. was born the 26th Day of and so is near the Church and Parish of I have hereunto fet my Hand the

Day of Minister of the Parish and Parish Church of E.F. Parish Church aforesaid.

Then the Petitioner must get a Certificate and Recommendation figned by as many of the neighbouring Gentlemen as he can; the more confiderable and well affected to the Government the Gentlemen are, the more his Petition will be regarded.

A Certificate and Recommendation to be fign'd by some of the principal Gentlemen in the Neighbourhood in the Gountry.

To the Honourable Commissioners of Excise. A Certificate and HESE are humbly to certify your Honours, and whom it Recommendation may concern, that C. L. of F. in the County of L. is a of some of the Person well known to us to be near the Age of 25 Years, of a so-men in the Country of L. 13 a principal Gentle-Part II.

## Of Obtaining Employment. Part II.

ber Life and Conversation, and well affected to the present Government; and, in our Opinion, very fit to serve his Majesty in the Revenue of Excise: Therefore, we bumbly recommend bim to your Honours for an Order to be instructed for a Gauger. Testimony hereof we have hereunto set our Hands this I.R.

Day of C.D.

But whether the Petitioner lives in London or the Country, he must write and take the following Oath, viz. that he has not made any indirect Application to be instructed.

The Oath, that the Petitioner has not indirectly endeavour'd to obtain an Order to be instructed. This Oath must be taken before, and sign'd by a Justice of Peace.

The Oath, that the Petititoner endeavoured to get an Order for Instruction,

C. L. do voluntarily make Oath, that neither I, nor any Person for me, bave, to my Knowledge, directly or indirectly has not indirectly given, or promised to give any Fee, Gratuity, or Reward to any Person or Persons what seever, for the obtaining, or endeavouring to obtain for me, any Order of Instructions for my Introduction into the Revenue of Excise, or Employment therein. Day of

It is very proper to get likewise a Certificate from the Collector or Supervifor, or this alone may do, but both are best.

Attestation of the Petitioner's Abi-

The Supervisor's The Form of a Certificate to be figned by the Collector or Supervisor.

To the Honourable Commissioners of Excise.

May it please your Honours,

R.C.L. of F. in the County of L. by whom this Certifi-\* See the Collec- N cate is written, is well skill d in Vulgar [and \* Decimal] tors Duty on p.3. Arithmetick, is of the Age of 25 Years, is a Man of fober Life and Conversation, is ingenious, and has a fair Character, for Integrity, is of a healthful Constitution of Body, and likely to make a good Officer; he is a fingle Man, and is well affected to the present Government, and of the Communion of the Church of England, as by Law establish'd: And this is humbly attested by Honoured Sirs,



Your Honours most faithful, And Obedient Servant,

Collector Supervisor.

If the Petitioner lives in London,

But if the Petitioner lives in London, and has Gentlemen of Figure and Credit that will wait on the Commissioners with him, at the Excise-Office, a Petition to the following Effect may be fufficient.

A Petition when the Person lives in London, and is persopally recommended by Gentlemen to the Commissioners at the Excife-Office.

The Form of the Petition.

To the Honourable Commissioners of Excise: The Humble Petition of A. B. of C. in the County of D. by whom this is written,

Sheweth.

HAT your Petitioner is well skill d in Vulgar and Decimal Form of a Petiti-Arithmetick; and he is of the Age of 27 Years, as appears on when the Perby a Certificate under the Hand of the Rev. Mr. E. F. of G. and fon, who lives in London, is perfois a fingle Man, of a sober Life and Conversation; is ingenious, nally recommend-and has a fair Character for Integrity, is of a healthful Constituted by some of the Commissioners at tion of Body, and well affected to the present Government.

Therefore he humbly defires your Honours will please to fice. grant him an Order, to be instructed for a Gauger within the City of London or Liberties thereof, or elsewhere. And, as in Duty bound, your Honours

Petitioner shall ever pray, &c.

The foregoing Certificates, &c. must be wrote upon diffinct Sheets of Paper, and fent to the Commissioners at the Excise-Office in the Old-Jury, London, Carriage paid.

N. B. That Orders for instructing Pupils are issued out at the Excise-Office only six Months in the Year, viz. from Michaelmas to Lady-Day, that being the Malting Season: So that it will be in vain for any Petitioner to expect an Order the other Part of the Year.

What farther relates to this Matter will be fufficiently, and I think best explained by setting down the Duty of the Collectors and Supervisors; as to giving Certificates, which is as follows:

HE COLLECTOR, when he has Application made to him Collector's Dufor a Certificate, in order to any Person's being instructed, ty when applied he must satisfy himself whether he be a likely Man to make a to for a Certifigood Officer, or not; particularly, that he is above Twenty-one, having an Order and under thirty Years of Age; that he writes a good Hand, for being instrucand understands the four first Rules of Vulgar Arithmetick; ted. that he is an ingenious Man, and of fober Life and Conversation; that he is an active healthy Man, and not encumber'd with Debts, or with a larger Family than a Wife and two Children; that he is well affected to the Government, and of the Communion of the Church of England: And finding him thus qualify'd in every Respect, the Collector is to certify the same gratis, and not to take any Manner of Reward for the same. And the Collector must further observe, that at the Bottom of the Certificate he is to express his Profession, if ever brought up in any; his Addition and Place of Abode; who he defires to be inftructed by; and to propose two substantial Persons to be bound with him, when employ'd, in a Bond of 200 l. for the due Execution of his Office; expressing also, the Place of their Habitation and Additions: And the Collector must give the best Account he can of their Circumstances. Which

Which Certificate, fo to be fign'd by the Collector, and also, the faid Oath, are to be written by the Person to be instructed, and must be expressly certify'd by the Collector so to be.

Supervifor's Duty as to certifying for those ing inftsufted.

HE SUPERVISOR, when any Person desires a Certificate of his Qualifications, in order to be instructed, must who would obtain certify, what Trade he has been bred to, if any, with his an Order for be-Place of Abode and Addition; whether married or fingle; if married, what Number of Children, (which must not exceed two) with the Names of his Sureties, and their Addition and Place of Abode, and Sufficiency to answer 200 l. and the Supervisor must not, at his Peril, sign such Certificate, unless the Party in every Respect appear to be qualify'd, and such his Qualifications are to be particularly express'd in the Certificate; and the Supervisor, for making or figning such Certificate, must take neither Fee or Reward.

The Petitioner, having obtained an Order for his Instruction, is put under the Care of an Officer, approved of by the Supervisor, for that Purpose. And in what Manner he is to be instructed, so far as I need to treat of that Matter (for I purposely avoid fetting down the Methods of Book-keeping practifed in the Excise, because that he is to learn from the Officer appointed to instruct him) he will find fet down on Page 16, under the Duty of those Officers that have the Care of Pupils. When he is fully instructed, he must be examined by the Supervisor,

whose Duty is as follows: The Supervi-

HE SUPERVISOR, before he certifies that any Person is for's Duty as to fully instructed for the Employment of a Gauger, must of him a Certifi-be well fatisfied, that he can cast up both Excise and Malt eate that they are Gauges, by the Sliding Rule; and that fuch Person has gauged and flock'd for a Month in the Division in which he was instructed, and entered the same in a Book to be by him made for that Purpose; and that he has made a true Voucher and Abstract therefrom; and that he is in all respects well qualified for a Gauger's Employment: And the Supervisor must take only 20 Shillings for such Examination and Certificate; and the Books, Vouchers, and Abstracts, being signed by the Person, Officer, and the Supervisor himself, the Supervisor must send to the Board at the Charge of the Person so certified for, or to bear the same himself.

> A Certificate from the Supervisor, that the Petitioner is compleatly qualified for a Gauger: Which must also be signed by the Officer by whom he was instructed.

> > Leverpool Division, Feb. 14, 1737.

Supervifor's Certificate,

HIS is bumbly to satisfy the bonourable Commissioners of Excise, that I A. B. have examined C. D. in the Excise, Malt, and Distillery, and find him compleatly qualified for a Gauger; he has all proper Instruments for taking and casting

up Gauges, and, in our Opinion, is likely to make a good Officer.
As Witness our Hands, the Day and Year above written.

J. B. Supervisor. C. L. Officer.

And after all these Steps have been taken; yet, if the Petiti- A necessary oner cannot obtain the Countenance of some Gentleman, (a vice of Ad-Member of Parliament is best) that is personally acquainted with one of the Commissioners, frequently to sollicit and remind the Commissioner of his Promise, his Petition will certainly come to nothing; for notwithstanding there are several Vacancies, what by Deaths, Discharges, &c. happening every Week; yet there are so many constantly applying, that those Petitioners who have the best Sollicitors always succeed soonest.

When the Officer is instructed, &c. before he offers to intermeddle in his Office, he must be careful to take the Oaths of Allegiance and Supremacy, and the Oath of Office, before one of the Barons of the Exchequer, or \* two Justices of Peace in that particular County where he is employed, taking a Certificate thereof, which he must fend to the Auditors of Excise at the Excise-Office in London, that it may be entered there as the Law directs.

## The Oaths of Allegiance and Supremacy.

A. B. do sincerely promise and swear, that I will be faith. The Oath of ful and bear true Allegiance to his Majesty King George; Allegiance.

So help me God.

A. B. do savear, that I do, from my Heart, Abhor, Detest, and The Oath of Abjure, as impious and heretical, that damnable Doctrine and Supremacy. Position, that Princes excommunicated or deprived by the Pope, or any Authority of the See of Rome, may be deposed or murdered by their Subjects, or any other whatsoever. And I do declare, that no foreign Prince, Person, Prelate, State or Potentate hath, or ought to have, any Jurisdiction, Power, Superiority, Preheminence or Authority, Ecclesiastical or Spiritual, within this Realm:

So help me God.

### The Oath of Office.

Y OU shall sever to execute the Office of truly and faithfully, without Favour or Affection, and The Oath of shall, from time to time, true Accompt make, and deliver to Office. such Person or Persons as his Majesty shall appoint to receive the same; and shall take no Fee or Reward, for the Execution of A 3

There is this Difference betwirt taking these Oaths before a Baron or two Justices: Those who have taken them before the Justices, if they are removed into another County, must take them de novo; whereas, the Baron's Certificate is sufficient for any part of the Kingdom; but then, for this the Officer usually pays 5 s. and but 1 s. for that figured by the Justices.

Of obtaining Employment Pt. II.

the said Office, from any other Person than from his Majesty, or those whom his Majesty shall appoint in that behalf;
So help you God.

A Certificate by a Baron of the Exchequer, that the Officer has taken the Oaths of Allegiance and Supremacy, and the Oath of Office.

Sir Thomas
Bury's Certificate
of the Author's
having taken the one of the Barons of her Majesty's Court of Exchequer, and took
Oaths of Allegithe Oath, for the due and faithful Execution of the Office of
macy, and the
Oath of Office.

By Excise, together with the two several Oaths, appointed by an
Act of Parliament, made in the first Year of the Reign of their
late Majesties King William and Queen Mary, Entitled, an Act
for abrogating the Oaths. Witness my Hand, the Twenty-seventh
Day of March, in the Year 1711.

Thomas Bury.

The Auditor of the Excite his Certificate, that he has register'd the Author's taking the said Oaths. XXXmo die Apr. 1711. Intrat. in Office Auditor per le Excise per

F. Stedman.

And at the next Term, or at the next General Quarter Seffions, after he is admitted into Employment, he must take the Test and Abjuration Oaths, as prescribed by the several Acts of Parliament, having sirst received the Sacrament, upon a Sunday in some Parish Church in the Presence of two Witnesses; and must take a Certificate thereof, signed by the Minister and Church-Wardens, in the Presence of the said two Witnesses, who are also to appear in Court where he takes the Oaths, to prove that he received the Sacrament, and that the Minister and Church-Wardens signed the Certificate.

A Certificate that the Officer has received the Sacrament according to the Usage of the Church of England.

A Certificate of having reserved the Satrament. W E the Minister and Church-Wardens of the Parish and Parish Church of Prescot in the County of Lancaster, do bereby certify, That Charles Leadbetter of Farnworth in the County aforesaid, on Sunday the Twenty-sourth Day of April, did receive the Sacrament of the Hold's Supper, in the Parish Church aforesaid, immediately after Divine Service and Sermon, according to the Usage of the Church of England.

In Witness whereof we have bereunto subscribed our Hands, the said Twenty-fourth Day of April, 1711.

George Abell, Minister of the Parish and Parish Church aforesaid. Thomas Johnson, S Church-Wardens of the said Jacob Tompson, Parish and Parish Church.

Eorge James and Richard Williamson, of Farnworth afore-I said, do severally make Oath, that they did see the said Charles Leadbetter, in the above written Certificate named, and who now present hath delivered the same into this Court, receive the Sacrament of the Lozd's Supper, in the Parish Church aforesaid, and that they did see the said Certificate subscribed by the said Minister and Church-Wardens.

George James. Richard Williamson.

### The Test Oath.

A. B. do declare, that I do believe there is not any Tran-Jubstantiation in the Sacrament of the Lord's Supper, or in the Elements of Bread and Wine, at or after the Consecration thereof, by any Person or Persons whatsoever.

The Oath of Abjuration.

A. B. do truly and fincerely acknowledge, profess, testify and Abjuration declare in my Conscience before God and the World, That our Oath. Sovereign Lord King George is lawful and rightful King of this Realm, and all other his Majesty's Dominions thereunto belonging. And I do folemnly and fincerely declare, That I do believe in my Conscience, that the Person pretended to be Prince of Wales, during the Life of the late King James, and fince his Decease pretending to be and taking upon himself the Stile and Title of King of England, by the Name of James the Third, or of Scotland by the Name of James the Eighth, or the Stile and Title of King of Great Britain, hath not any Right or Title what soever to the Crown of this Realm, or any other the Dominions thereto belonging; and I do renounce, refuse and abjure any Allegiance or Obe-And I do fwear, That I will bear Faith and true dience to him. Allegiance to his Majesty King George, and him will defend to the utmost of my Power against all traiterous Conspiracies and Attempts what soever, which shall be made against his Person, Crown And I will do my utmost Endeavour to disclose and make known to his Majesty and his Successors, all Treasons and traiterous Conspiracies which I shall know to be against him or any of them.

And I do faithfully promise to the utmost of my Power to support. maintain and defend the Succession of the Crown against him the faid James, and all other Persons what soever; which Succession (by an Act, intituled, An Act for the further Limitation of the Crown, and better securing the Rights and Liberties of the Subject)

# Of obtaining Employment Pt. II.

Subject) is and stands limited to the Princess Sophia, late Electress and Duchess Downger of Hanover, and the Heirs of her Body, being Protestants. And all these Things I do plainly and sincerely acknowledge and swear, according to these express Words by me spoken, and according to the plain and common Sense and Underfanding of the same Words, without any Equivocation, mental Evasion, or secret Reservation whatsoever. And I do make this Recognition, Acknowledgment, Abjuration, Renunciation and Promise heartily, willingly and truly, upon the true Faith of a Christian.

The Form of the Author's Discharge with the Collector's Letter accompanying it.

Worcester Excise-Office, Aug. 30th.

Mr Charles Leadbetter,

The Collector's YOU are to deliver to the Bearer Mr William Singer, who is appointed to succeed you, all Books, Papers, Vouchers, Abstracts, or whatever else relates to Stores belonging to her Majesty: The underwritten, is a Copy of your Discharge.

I am, Sir,

your Friend and Servant,

Charles Harris.

Bromfgrove, 2d O. R.

Excise-Office London, Aug. 19.

The Author's Discharge.

SIR,

R Charles Leadbetter, Officer of Bromsgrove 2d OutRide, being order'd to remove to Henley O. R. and refusing
to comply therewith, or to deliver up his Books to the Officer, who
was to fucceed him, as by your Letter of the 17th Inst. the Commisfioners have order'd, that the said Mr Leadbetter be discharg'd.

I am, Sir,

your humble Servant, Samuel Johnson.

The true Reason and Grounds of my Discharge was this.

PON Sunday the 9th of August, Thomas Brooks Officer at Henley-Arden came to me at Alchurch; which Day he was very drunk; he said that he and I must change Divisions, but brought me no Note either from the Collector or Super-visor: For these Reasons I told him our Sitting was next Tuesday, and then I should have Orders from them, if it was so. He staid and dined with me, and went home far from being sober; and told his Supervisor, Mr Anthony Gelder, that I refused to remove; which was actually salse. Since this may possibly be of Service to others, I thought proper to make it publick.

In Witness of the Truth hereof, I have hereunto put my Hand this 24th Day of June, 1738.

Charles Leadbetter.

N. B.

N. B. When any Officers are order'd to be discharg'd, the Collector's Du-Collector must not pay them their Salaries, till they have delicty as to Stores when an Officer is yer'd up their Commissions, and their Acts of Parliament, and discharged.

the feveral Books and Stores that belong to their Divisions.

When any Supernumerary \* or other Person officiates for any when he officiates fick Officer, the Collector must pay to fuch Person, so much to have full Salaas will make up full Officers Salary for the Time he officiates, ry and which and what he so pays more than the Salary Book will bear, he way he must place it to the Account of Incidents. But when any Supernumerary, or other Person officiates for an Officer, who has Leave to be absent, the Revenue is not to bear the extraordinary Charge, but the ablent Person must pay what shall be occasion'd thereby.

N. B. When the Supernumerary is officiating for any Office Collector must cer, who is fick or absent; if the Collector shall want one to portmantua carry the Portmantua, he must hire one; and if this be occa-when the Superfion'd by Reason of an Officer's having Leave to be absent, the numerary is offi-Charge must be born out of the Salary of such Officer; but if ciating. by Reason of the Sickness of an Officer, such Charge must be

placed to the Account of Incidents.

## CHAP. II.

Shewing the Business and Duty of those Officers of the Excise, who Survey Victuallers, By-Brewers, Common Brewers and Diftillers.



AVING in the preceding Chapter very plainly and fully instructed the young Officer, in the Methods to be made use of for obtaining Employment in the Excise; I shall now proceed in shewing him his Duty, and the Nature of his Business, when he is an established Officer.

It is requisite the Officer should demean himself respectfully The Officer to all Magistrates, and civilly to all Persons whom he surveys; celf respectfully and he must shew his Commission (for which Reason he must to every one, an always have it with him) to any Persons that he surveys, if they shew his Comdemand to see it. It is absolutely necessary, that the Officer mission when it is should be skilful in Gauging of all manner of Vessels, Casks Must be skilful or Utensils; and he must provide himself with proper Instruir Gauging, and ments for taking the Dimensions of all Vessels, containing provided with exciseable Liquors, and for finding the Contents, or Areas of such ments. exciseable Liquors, and for finding the Contents, or Areas of such ments. Vessels, &c. The following are the Names of the seven In-

The Supernumerary, is a Commission'd Officer, who attends on the Collector, carries the Portmantua from Place to Place during the Round; receives Half-pay; and when a Vacancy happens he goes into Business: as soon as that happens the Collector acquaints the Board, and they immediately order him another Supernumerary, who receives his Commission when he somes to his Collector.

struments which are enjoined by the Commissioners; and whoever is not provided with them, is not regularly qualified to be an Officer.

1. A Cane or Holly-Stick inched and decimally divided. See The proper Infruments particu-Plate II. larized.

2. A Sliding-Cane for taking the Dimensions of large Ci-

fterns, Coppers, &c.

3. A Sliding-Rule for the expeditious casting up of Gauges. and for taking the Dimensions of small Tubs, &c. See the Plate. 4. A Box and Tape for taking Couch and Floor-Gauges of

Malt.

5. A Brass-Plate for taking Malt Gauges.

6. A Cork-Plate or Plum, for taking Gauges of Ale or Beer when working in the Fatt.

7. A Brass-Receiver for fishing up the Barley from the Bot-

tom, or any other Part of the Ciftern, &c.

N. B. Some have also Breman's four Foot Sliding-Rule. Whatever Entries and Notices are given by Common-Brewers, or by other Persons liable to the Survey of Officers of must be carefully kept on Files, lock'd up by Excise, the respective Office-Keeper \*; and as soon as the Office-Keeper receives fuch Entry or Notice, he must before he puts the fame upon the File, write upon it the Day of the Month, and Year of our Lord, when he received it. The Officer must frequently examine the above-mentioned Files, and as soon as he finds any new Entry or Notice given, he must Copy the fame into a Book kept at the Excise-Office for that purpose; and the Office-Keeper must sign all such Copies, to testify that they are true: The Officer as foon as possibly he can, after are made, the Of-fuch Entry is made, must repair to, and require the Person who diately repair to made the fame, to shew him every Place and Thing menti-

> of the Rooms, &c. in his Entry-Book, and mark the Particulars in such a Manner, as may enable him, his Supervisor, or any other Person readily to find the same at any Time.

Great Inconveniencies have arisen from the Officers Writing Entries for those who are subject to their Survey; and therefore, it is strictly enjoined, that no Officer presume to write any Person's Entry for him. N. B. The Malsters and Hop-Planters Entries, which are to be made annually, must be copied into Books by themselves. The Officer must reside at fuch Place in his Division, as the Collector and Supervisor approve of; fo that he may be able to fecure, as near as possible, every Branch of the Revenue committed to his Care. And as early as possible every Morning, he must survey his whole Division if it be a Foot-walk; but if he has a Ride, he must furvey his Place of Residence, before he goes into the Ride, except there be Gauges depending in the Ride, which makes

Of Entries by those liable to be surveyed. Office-keeper Duty as to En-

Officer must frequently examine the Entry-

After Entries ficer must immethose who made oned in the Entry: He must immediately describe the Situation them.

Officer must never write any ones Entry for

Malsters and Hop-planters Entries made annually.

Foot-walks must be surveyed early every Morn-

Rides how to be furveyed.

\* Is he that keeps the House where the Collector holds his Sittings,

it necessary for him to hasten thither; and in such Case, he may survey that Part of his Ride, before the Place he resides at. Then as to such Officer who has a Ride, if he can survey his Of Rides that Ride in one Day, he must survey the same at least four Times can be surveyed a Week; and he is to stock it three Times, or oftner if he in one Day. fee Occasion; and if he cannot possibly Ride it under two Days, Of Rides that he must survey and stock the same three Times a Week, or can't be rid unat least five Times a Fortnight: But then this is not to be doneder two Days. in one constant Course, nor must he begin always at the same Place; but he must sometimes Ride the same Round twice following, and he must so contrive it as to double at such Times, and upon fuch Houses, when and where the most useful Gauges and Observations may be had; so that by surveying at Times unexpected, he may get the more Gauges, and probably discover unfair Practices. The Officer must take as Must not almany Gauges in the Ride as possible, and must use his utmost ways ride the Endeavour to find out the best Lengths + of every Victuallersame Rounds, &c. in his Division. T And at such Times as he cannot have many Gauges a Gauge, and he finds the Tunnage short of the best Lengths, and find out the which he used to have by Gauge, he must inform himself whe-best Lengths pos-ther the same Quantity of Malt was used in that Brewing, His Duty which was used when he had such best Length; and he must when the Tunlikewise observe, whether the same Quantity be tunned, and nage is short of the best Lengths, whether any \* Plus-Drink remains; and he must use his best per Gauge. Endeavour to draw a true Confession from the Victualler, whether any has been fold, drank, or otherwise disposed of; or whether the fame Quantity was made as in any former Brewing; and enter a Memorandum thereof immediately, at the End of his Stock, that he may be able to justify his Charge on any Occasion, when called upon for that Purpose.

The Officer must observe, That the most material Part of his Division may be more closely attended on; and where it falls out that any inconsiderable Victualler lies so very re-who live remote. mote, as to cause any Neglect of more considerable Houses, in that Case he may make such cautionary Surveys only, as the Collector and Supervisor shall think necessary and approve of: But before he offers to take that Liberty, the Collectors and Supervisors Directions must be entered in the Front of every Excise-Book, and signed by themselves. If in his Division he Of Compounhas any Compounders, he must enter their Names, and Places ders. of Abode, in some convenient Part of his Stock-Book, in order to furvey them cautionarily; and upon each Survey, he must enter their Stocks and Gauges, as he does by Victuallers; but he must distinguish from the rest such Drink in Stock, as was Surveys made brewed since he last surveyed them. The Officer is to observe, in the Night that when his Surveys are made by Night, they must be in the Presence of a Presence of a Constable, or other lawful Officer of the Peace, Constable, &c.

in Case he cannot have Admittance without one; and when he How Entrance must be demandmakes ed,

t Length is the Quantity of Gallons brewed at each Time, Plus-Drink fignifies what is left after the Cask is filled.

makes a Demand of Entrance, into any House under his Survey, he must for a reasonable Time, knock, ring, or call, at the Gate, or Dwelling-House, or such other Place where he has usually procured Entrance; and if he is not admitted on so doing, he must with a plain and audible Voice, make a Demand at the faid Gate, and Dwelling-House, or other Place, in Words to the following Effect, "I

The Form demanding

Proper to have Witness when Entrance

s demanded in

the Day-time.
Must stay a scafonable Time

" or Officer of Excise do demand Entrance into the

to gauge, furvey, or take an as the Law directs." " House of Mr " Account of his

He must observe, that as the Demand must be made in the Presence of a Constable, if it be by Night, he must mention in his Demand that a Constable is with him; and if the Demand be made in the Day-time, he should, if possible, have some fufficient Witness present, to prove his making such Demand; and after he has so done, he is to stay a reasonable Time, before he goes from the house, or Place; and he must enter the Must acquaint denied him, he must, if possible, acquaint the Person or his Servant of he Danger.

Of depending

The Officer, as he goes round his Division in a Marrian.

the Copper.

When the rifion is very

Of a House twice furveyed in The Word

large.

Cyphers.

the Place of his Refidence, must take Gauges of all the depend-Gauge as foon as ing + Guiles, and he must return on such as he found at Work, and on fuch as he fuspects will work, so as to take a Gauge of each wort, as foon after it comes out of the Copper as possibly he can, that he may, if possible, have distinct Gauges both bot and cold, on each Wort; and he must take into Stock every Brewing must be Brewing the next Day after it is tunned, if the Nature of his where his Di- Business will permit: But if his Division is so large, that he cannot have a Gauge on each Wort distinctly, at all the Victuallers, he must take the Gauges on the Worts distinctly, at as many Houses as he can; sometimes at one, and sometimes at another: And when the Officer makes two or more Surveys at one House, in one Day, the Day and Hour must be entered to each Visit, and not the Word Ditto or Do; nor must he when Ditto to be avoid-Diameters, &c. are to be repeated, or in any other Case, write in his Books the Word Ditto. The Officer when he enters a Depth, or dry Inches, a Diameter or Length and Breadth, Of the using which is less than ten Inches, he must place a Cypher before it; if it be a Depth under one Inch, two Cyphers are to be placed before the Decimal; or if it be a Depth, Diameter, &c. in even Inches, he must put a Cypher in the Place of Decimals; and after he has entered his Gauge of all the Worts, and before he leaves the House, he must observe to dash through every Gauge of Wort, so warm as to require the Allowance of one Tenth Part for Wash and Waste, he must annex a (W) to the

The Officer nuft dash through vacant Column in the Gauge-Place. When the Officer takes a all the vacant Deduction where the Worts Character of fuch Wort, and deduct one Tenth Part thereof in are gauged warm,

A Guile fignifies all the brewing of Worts put together.

the Casting; and when he takes the last Wort of a new Guile, if any former were not cleansed, upon his Morning Survey he must be sure to take an Account thereof, either by Gauge or Tunnage. He must also take Gauges of the Goods as often as he Gauges as often as he Gauges as often as he can, and enter them in his Book, though at the Time of tak-as he can ing thereof, the Worts are not sit to be gauged. When it happens that a Victualler, (or common Brewer) declares that the Small-Wort of one Brewing, will be brought over the Goods of a succeeding Brewing; the Officer must gauge such Wort, and characterize it with R; and if upon his following Surveys he finds the Wort so returned or brought over, which, if possible, Should see is to be done in his Sight, he must write in his Book that the returned, if possible wort was returned, and in such Case no Charge is to be

made upon it.

The Officer to prevent his Attendance longer than is How the Ofnecessary, to see such Worts returned, must advise the People sicer may comto give him Notice of the exact Time when they intend to do him Notice of res it; which he may bring them to comply with, by charging turning. the faid Worts, when they refuse or neglect to give such No-And feeing feveral Persons do dispose of, or sell tice to him. their Small-Beer raw, or unboiled, the Officer must endeavour fold raw. in such Case to survey before any is disposed of, and take a Gauge thereof, either in the Under-Back or Cooler, or other Vessel where he finds it, and charge the same with the Duty. The Officer must never take Gauges, Stocks, &c. on loose Pa- Must never per, but he must enter them on his Book, before he leaves each take Gauges, House, the Stocks, Gauges, &c. taken at such House, and the Stocks, &c. on Time of his Survey. The Officer must be sure to cast up his Gauges must Gauges every Night, and also to set forward his Charges, viz. be cast up every I. From the best separate Gauges of the strong Worts added to Night. gether: Or, 2. from a Gauge of those Worts mixed, if it be ner this must be better than the separate Gauges thereof: Or, 3. from the done. Stock if that exceeds the best Gauge, he must make the Charge of each Brewing, which is to be fet forward feparate.

The Officer must make his Figures large, and keep all his Figures must Books fair; he must not at his Peril scrape, scratch, or alter No scraping, any Figure, Character, or Remark, in any of his Books; but altering, Sec at if he happens to make any Mistake in entering his Gauges, the Officer's Pestocks, &c. he must draw a small black Line through such How Missack, so that the Original may appear, and enter a Memotakes are to be randum what the Right is. And note, the Mistakes which may reclified without happen in transcribing the Areas of Utensils, or Contents of Mistakes in Casks, must be rectified and signed by the Supervisor. The transcribing A-Officer must not survey ina cursory or careless Manner, but with to be rectified. Such ow to be rectified. Such ow to be rectified. Such ow must be made most Diligence, to prevent or detect, all Frauds in every Duty tion.

Intent.

I Under Back is a Cooler that stands under another,

Intent, he must not offer to make any Composition for the same, but must give a true Account thereof in due Time to the Collector, or Supervisor, who are to acquaint the Board therewith, to the End that the Person may be legally prosecuted for the fame.

Victuallers where to be flocked.

Must never be above three Days wide in the Stocks.

The Officer must stock the Victuallers where he resides, at fuch times as may least hinder his taking Gauges; though he flock not all in one Day, yet so that the whole be flocked three times a Week, or at least five times a Fortnight; and he must never be above three Days wide in the faid Stocks. When the Officer has in his Division a Victualler who brews himself, and also takes in Drink from common Brewers, or Victuallers; he must not intermix the Stock of these true Sorts of Drink, but must keep them separate, even though the Drink bought in be in the Victuallers own Casks; and when it comes in, he must write against the stock, the Brewer's or Victualler's Name, and the Division it came from, to the End he may not be imposed upon, but may charge fuch Victualler with the Duty for all the Drink he brews; and where he finds just Cause to suspect a Fraud, he must charge the whole Increase he finds in Stock, and let the Victualler discharge himself by Course of Law as he The Officer must keep all his Victualler's Casks fairly Casks must be can. kept fairly mark-numbered, with white Lead and Oil, and reduce the Numbers to as few as he can, that the Stocks may not be extended to an Number redu-unnecessary Length. Note, that the Number and Contents of all the Victuallers Casks, and the Areas of all their Mash-Tuns,

ced to as few as poffible.

The Officer

must give every one timely Notice of the fitting Days, &c.

The Officer's Duty concerning By-Drinks.

Must receive

Must keep Stock on By-Brewers.

When his Surveys need only to be cautionary.

into every new Survey-Book. The Officer must give all the People in his Division, who are to pay Duty, or make their Entries, timely Notice of the fitting Days. And he must attend at the Excise-Office at such times as the Collector shall appoint, and bring his Survey and Dimension-Books, his Acts of Parliament, Instructions, General Letters, and Instruments, at his utmost Peril.

Under-Backs, Coppers, Backs, Guile-Tuns, or other Utenfils, in common Use, must be transcribed from his Dimension-Book

The Officer must diligently enquire after, and be careful to take an Account of all Drink fold at Fairs, Wakes, Revels, or any other publick or private Meetings, and then to demand and receive the Duty, for the same; but he must not at his Peno Money for By-ril, receive the whole, or any Part of the Duty due for such giving a Receipt. By-Drink, without giving a Receipt at the same Time for the Money he receives; expressing therein, the Quantity, and Quality of the Drink, the Day when charged, and the Day he receives the Money: Also he must keep Stock on all By-Brewers, taking Gauges on as many as he can, and enter them in his Book, in the same Manner as Victuallers; only distinguish them by the Words (By-Br.) but when the Drink is in Casks, and he has charged all that they have in their Possesfion, his Surveys need only be cautionary, and not fo frequent as upon Victuallers. Those Persons who usually sell Drink at Fairs, Fairs, Wakes, &c. and brew as well for their own Families, Of those who as for Sale, have a Right to enter, and pay the Duty for fell Drink at what Drink they sell at the Fair only; and are not required to brew as well for enter all in their Possession: But then the Officer is to be satistically their own Families that they shew him all their Drink, that he may have Recourse to, and keep stock upon it: And the Officer may admit May be admitted to make Post-Entries if they will sell any more than they ted to make Post-entered at first. But if by any Means he discovers that a greater Entries. Quantity is sold than was entered, he must charge it, whether strong or small, and acquaint the Collector or Supervisor therewith, that the Offenders may be prosecuted as the Law directs.

Note. All these Particulars, upon the Collection-Day, the Must enter all Officer must enter into the Collector's Book for By-Drink, and these Things in fign his Name thereto; and pay the Money he has received for By-drink Book.

fuch By-Drinks, to the Collector.

The Officer must not offer to return any as By-Brewers, None must but such as sell only at Fairs and on other accidental Occasions; be returned as nor must he keep any Person as a By-Brewer, who continues to such as sell drink brew Drink for Sale above two Rounds together, at his Peril. on accidental Occasions. The Officer must not receive the Duty due from any Person and Must not receive whatsoever, except for By-drinks only, nor bring any Person's any Money but Money to the Collection, nor take up any Arrears between for By-drinks, cathe Rounds, without Directions first had in Writing, signed by the Collector, at his Peril.

The Officer must not keep a Publick-house nor deal Officer must in any Commodities, nor must be Trade with nor borrow any not keep any Money of, nor accept any Treat, Fee, or Reward, from any nor accept any Person chargeable with any Duty under his Survey, or from Treat, Sec.

any one employed by them. Nor must he survey his Relations or Securities at his Peril.

The Officer when he first comes into a Division, must The Duty of enter his Name in the front of each Survey-Book, the Time the Officer when when he received it, and the two first Letters of his Name, he first comes into to the first Surveys and Gauges he takes throughout the said when he officiates Books: But if he officiates in another Officer's Division on for another. any Occasion, in that Case he must set the two first Letters of his Name to his first and last Surveys and Gauges, in each Book; also his Name in the Front, with the Time that he officiated in that Division.

The Officer when he is removed from one Division to TheOfficer must another, which he must never sollicit for or against, by any never sollicit for a other Method than his own Letter to the Board; he must his own Letter. mention in the Fronts of the Books of that Division he leaves, the Time he left the same, and he must put his Name thereto, and must leave the Acts of Parliament, Instructions, Books of Permits and Certificates, General Letters, and whatever Must take a Books and Papers belong to that Division, taking a Re-Stores. ceipt for the same from the Supervisor, or the succeeding Of instructions Officer, who received them from him. Note, in case any given by a Com-Survey.

Commissioner upon a Survey shall give him any Directions in Writing, which may respect that Division or Place where such Directions shall be given, he must immediately enter the same at the End of his Printed Instructions, that both the Supervisor and his Successor may observe the same as well as he himself has done.

The Officer's Duty, who has

of Pupils.
Pupils must Gauges for the Officer, nor the Officer to take Book.

Officer's Fee is 40 s.

Great Dif-Serence between the Bufinels of those Officers who gauge Victuallers, and

The Officer's Duty where he Once every

certain Returns

at work. Must take a it comes out of the Copper, and also a cold

is in the Copper of which he has not had a

Tho' not separated from the Hop.

His Charge if he apprehends Wort has been privately re-

Officer must enter the Con-dition of the

The Officer when he is directed by Order of the Board. to qualify and instruct any Person for a Gauger's Employment, he must not offer to certify him qualified for such Employment before he can cast up Malt, and excise Gauges by not survey or take the Sliding Rule; and he must not suffer such Pupil to survey or take any Gauge for him, nor must he take any Gauge or Surveys from his Pupil's Book, nor permit him to transcribe any Gauges, &c. from his; but at all 1 lines, which as if he were then actu-from the Pupil's kept as punctually to his Survey, &c. as if he were then actufrom his; but at all Times, whilft instructing, he is to be ally an Officer; and for his instructing such Person he shall not receive from him more than 20 s. when he comes to be inftructed, and 20 s. more when he is certified for and instructed.

As different as the Bufineis of a common Brewer is from that of a Victualler, who retails what he brews, fo different is the Business and Duty of the Officer who surveys him; the Officer then that has the Care of common Brewers is to furvey those who survey those where he resides twice a Day, though they are silent, if common Brewers. his other Business will permit him so to do, and once at least every Sunday when they are at Work; he must make frequent Returns to the Brew-Houses, and at uncertain times and at each Return he must take a Gauge of every Guile that Mult make un- is depending, and of what Worts are off of the new Guile, though no more be off than when he was last there, always enupon them when deavouring to take a Gauge of each Wort, so soon as it is possible, after it comes out of the Copper, and a cold and Gauge as foon as confirming Gauge as well as a warm one on each separate Wort; and where there is a Wort in the Copper of which he has not had a Gauge, he must return, though it be in the Night, Gauge. at such Times as he may get the best Gauge thereof; but in When a Wort Case the said Wort hath done boiling, and is not separated from the Hops, either in the Copper or Hop-Back, he must take the true Gauge thereof, and write (bot) over it, but not make any Charge therefrom, unless from his following Gauges he hath good Reason to believe that some Part of the faid Wort hath been privately conveyed away; and in such Case he must charge from his Gauge, making such Allowance only as he thinks reasonable on Account of Heat and Hops. The Revenue may be greatly injured by a Fraud that has frequently been committed by leaving Part of a Wort in the Under-Back; the Officer therefore must frequently examine the fame, especially when the last Wort is in the Copper, and When a Fraudenter the Condition thereof in his Book; and where he to be suspected finds an Hop-Liquor left in the Copper, he must observe

carefully how the same is disposed of, that no Fraud be covered

thereby, as has been frequently practifed.

The Officer must observe to keep the dipping Places of The dipping the Vessels and Utensils, with the Additions and Abatements, Places must be if there be any, fairly marked on them; nor must he take the marked. The Gauges of Gauges of two Backs by dipping only in one of them, unless two Backs must the Communication be so wide, as not to be stopped without not be taken by being discovered; he must frequently examine the Position of only dipping in the \* Backs to see if any Alteration hath been made since they The Backs to were last set, which is to be done by taking Drps in several be examined to see it any Alte-Places, or feeing the Worts in them let down into a Tun.

The Officer must make himself Master of the several Cha-therein. racters used, to denote the different Worts, which are as fol- ters us'd to di-low. In entire Guiles of strong, or in party Guiles, as the stinguish the dif-Worts come off, you must Character them in the following ferent forts of Manner. If but Two Worts, the First b. the Second bl. If Worts. Three, the First b. the Second m. the Third bl. If Four, the If 3 Worts. First b. the Second m. the Third n. and the Fourth bl. and this Character \* must be used for all Worts of the Quality of Strong that are down in the Tun, though the Length be not declared the fame Character must be used for all Worts declared Strong, whether they be in the Backs or Tuns; and this Character VI for all small Worts when they are declared so. But in entire Guiles of small the first Wort must be charactered it the Second it 3 small Worts. the third wi. &c. W. fignifies the Gauge was taken when If warm Gauge. the Wort was warm, and R. that it is intended to be returned returned. on the Goods of a fucceeding Brewing |.

The Officer as foon as he can after all the Worts of any To demand Guile are off, must demand of the Brewer or his Servant, how how much strong much strong Beer or Ale, and also how much small the Brewer and how much much strong Beer or Ale, and also how much small the Brewer small the Brewer intends to make of fuch Guile, and infert the Answer he re-intends to make ceives in his Book, with the Person's Name that gave the same, of each Guile. And if any Part of a Guile be cleansed before the Brewer Duty when the or his Servant has made such Declaration as aforesaid (he Guile is cleansed. having been required by him so to do) the Officer is to Charge If any increase the whole Guile strong, or if after the + Length has been de-after the Length clared, he finds any increase of strong contrary to Law, or any If a Guile is de-Part of the Guile laid off over and above the Length declared, clared all small, he must acquaint the Collector and Supervisor therewith the and he finds first Opportunity, and if the Guile be declared all finall when the Worts are separate, and some of them above the Quality of fmall, he must acquaint the Person, who declares that the Part II.

\* Is what great Brewers cool their Worts in, and those are frequently placed one under

ration is made

If 2 Worts.
If 3 Worts.
If 4 Worts.

Strong Worts,

If finall Wort.

another.

|| When two or more strong Worts; the first Wort (or Hop) must be marked with b; the second Wort (or Mash) with m; the third Wort (or Neighbour) with n; and when the whole Brewing is intended for E. (or strong) the last Wort (or blue) must be marked bl. There are likewise some other Characters frequently to be met with in the Officer's Books, i. e. L. for Liquor, (that is Water,) W for E. Wort. Pw. for a Piece (or Part) of a Wort. T. Sp dg. for Tapfending or the Wort running from the Mash Tun v1 r for small Beer raw, or unboiled. O denotes the Goods to be gone; E. for Stout or Beer that is above the common Quality.

1 Is the Quantity of Gallons or Barrels brewed at a Time.

In case the Brewer perfifts in fuch Declaration.

Finings must

How the Party-Guiles must be charged.

When the Brewer makes up his Length of ftrong with that intended for fmall.

If the Brewer brews in little Quantities, and fe don.

But a Gauge must be got as foon as the Wort s out of the

Liquors. Any Officer inermeddling in Elections forfeits

Worts then above the Quality of small will be charged strong, which probably will prevent his making any Declaration till the Worts are all down and mixt in the Tun; but in case he infifts on that Declaration, the Officer must enter the same in his Book, remarking fo much of that Guile strong as appears to him to be above the Quality of final at that Time; and he must Charge it accordingly, if he has not an Opportunity of seeing the Worts mixt, or of taking a Gauge of them after mixt; and if when the Length is declared there be Finings, which canbe gauged or en- not be gauged, he must require the Brewer to declare the Quantity of Finings, and he must accordingly enter them in his Book.

In making up the Charge of each Guile when a Brewer in a Party Guile makes one or more Worts ftrong, and does not use any of his small Wort to make up the Quantity of strong intended; and upon the Declaration of his Length the Officer has no Reason to believe from the Gauges he has taken, that any of the small Wort or Worts are missing, or that any of the strong Wort or Worts are or have been mix'd with the small; in this Case the Officer must collect the best Gauge of each strong Wort, and the best Gauge of each small Wort, and make his Charge of strong and small from the feparate Totals of them, or from any better Gauge that he afterwards takes of the strong or small, when Part thereof is up and Part down, or when all is down in the Tuns. But, when a Brewer makes up his Length of strong, by Part of the Wort or Worts intended for small, or è Contra, the Officer must collect the best Gauge of each Wort, and add them together, and from that Total if it be most, or from any inix'd Gauge of two or more Worts together, or from any Gauge that makes a better Total, deduct the small declared and charge the Remainder strong; but if the strong declared, or any subsequent Gauge thereof exceed such Remainder Charge from that, or if there be any subsequent Gauge of the small, better than when the Length was declared, that is to be the Charge.

There are feveral common Brewers who brew but feldom, and little Quantities at a Time; I fay, where this happens, and the Officers have much other Business, the Collector and Supervisor may give them leave to survey such Brewers but once a Day, when filent, and not fo often on brewing Days, as they are enjoined to survey great common Brewers; yet they must take care to get a Gauge of each Wort as soon as possible, after it comes out of the Copper.

N. B. When the Officer feizes any excifeable imported Liquors or other Goods, he must acquaint the Board therewith Copper. quors or other Goods, he man acquire the of feizing ex- the next Post, that Directions may be given touching the

Condemnation of them.

No Officer of the Excise must endeavour to perfuade any Elector to give, or diffuade any one from giving his Vote, for the Choice of any Person to be a Member of Parliament; for such Officers as do so intermeddle with Elections, not only forfeit the Sum of a 100% but are also by Act

of Parliament, rendered incapable of any Employment in the Excise, or any Office of Trust under his Majesty whatsoever.

#### CHAP. III.

Concerning the Business and Duty of those Officers of the Excise that survey Malsters, and those that deal in Cyder and Perry; so as to prevent those Traders from evading the Duty, and defrauding the Revenues.

Walters in his Town, once at least often to be surevery Day, and twice where the best Cistern-veyed. Gauges, and the best Couch-Gauges are depending; and if these Surveys are made in the Night, mus be in the Presence of a Constable, or

Where a Dif-

other lawful Peace-Office, in case he cannot have Admittance without them. The Officer who has a RIDE, that he can ride Rides how often in one Day, must survey the Malsters at least four Times in a to be surveyed. Week, or nine Times in a Fortnight; and where his Division is such, that it cannot be rode under two Days, he must fure The Officer vey the Malsters thrice a-Week if possible; but this is not all should double up-ways to be done after one and the same Manner, nor beginning on the Malsters always at the same Place; but fometimes to ride the same to discover Round twice together, so that by doubling upon the Malsters, Frauds, and surveying them at times unexpected, he may get the more Gauges on the Steepings, and thereby more likely difcover Frauds. And where the Officer's Division may be rode all in one Day, he must not divide it into two Days Riding, Of the Dito avoid surveying as is above directed. The Officer must mensions of the enter the Dimensions and Areas of each Cistern and Uting-Fistern, Uting-Fat into his Malt-Book; and where Couch Frames are used, he Frames. must take their Dimensions when they are empty, and enter the same with the Area at the Top of his Leidger; but then he must not entirely depend upon those Dimensions, but he must try the same upon every Gauge be takes. He must likewife in the Town where he refides, take care that one of his The Officer Gauges be taken, (if possible) some short Time before the to take one Water is let out of the Cistern, or † Uting-Fat; taking the before the Wa-Depth in three or four Places: and he must be careful before ter is let out of he takes his Gauge, that the Corn be raked or made level, the Cistern.

To see the and of an equal Depth, as near as may be, throughout all Com lye level, the Parts of the Cistern; so that by raking the Corn from the Middle to the Sides of the Cistern, as has frequently been practifed, he may not be imposed on, by taking his Gauge in such Part of the Cistern, where the Corn is not so deep as in Where a Disother Parts. And when he finds any Difference as to the Depth to take it Depth, then he must take it at a Medium, and enter it in his at a Medium. Leidger as the true Gauge; and he must take all his Gauges All Gauges to
B 2
with Brate-Plate.

Is the Ciftern or Tub that Barley is wet or fleeped in.

Gauges,

Of using of must be taken

with a Brass Plate on his Rule or Cane. He must annex Cy-Cyphers. When Gauges phers to Depths and Diameters at even Inches, and prefix Cyphers to Depths under Ten Inches. When the Barley or other Grain has been thrown out of the Ciftern, and before it has lain Thirty Hours out, the Officer must take one or more Gauges of it, viz. One as foon as he can after it has been thrown out, and another as near the end of Thirty Hours as his other Business will admit; and he must enter in his Book the Length,

If a Square or Breadth, and Depth of each Couch-Gauge, in case it be of a Oblong. If a Circle. Square or Oblong Form; and if it be a Circle, the Diame-The Hours out. ter and Depth. And in case it be his first Couch-Gauge, he must Of denoting the express the Number of Hours the Corn has been out of the Time out of the Ciftern, before which Number of Hours, if under Ten, he must fet this Character O, viz. a Cypher with a Dash through it; and so he must do before the Hours in the Cistern when they are under Ten: And this Mark is to be fet on the Left-

Gauge, and how Floor-Gauge.

Floor-Gauge is have any subsequent Floor Gauge, when the Allowance of Ten 10 Bushels in 20 or 1. Allowance on a

Must examine that the Couch one wetting.

Must observe the Corn is not dition of the Ciftein to be entered.

been above 30 Hours out of the

Of taking a Compare-Gauge.

Of the best of Hand of the Hours. Note, the best of your Cistern or Couch-Cistern or Couch-Gauges, is to be entered in the Column for the best Gauge, Gauge, and how and that is to be the Charge; unless the same happen to Duty when these be exceeded by some subsequent Floor-Gauge in manner solare exceeded by lowing, viz. Notwithstanding the Officer's having taken the forementioned Couch-Gauges, within Thirty Hours after the Corn is out of the Cistern; yet he must continue his gaug-Allowance on a ing the Corn until it be quite dried off; and where he shall

in the Score is deducted, which shall exceed the best of the Ciftern or Couch-Gauge when the Allowance of Four in the Ciftern or Couch-Score is deducted ; then he must Charge from fuch Floor-Gauge ; Gaugeis 4 Bushels and when he is taking the Couch, or Floor-Gauges, he must with his Hand, or otherwise, examine and endeavour to discover whether such Couch or Floor be all of the same Wetor Floor be all of ting : and if he finds any unfair Addition made from private Wettings, or any Mixture of one Steeping with another, before the same is put on the Kiln for drying; or that the Corn which is in steeping, or that hath been steep'd, to be rammed, pressed, trodden, or otherwise forced together, he must inform the Collector and Supervisor therewith, that an Infor-When the Con- mation may be laid against such Offender: and whenever the Officer takes either any Couch or Floor-Gauge, he must enter the then Condition of the Ciftern or Uting-Fat, and By-Tub respectively. And in such Places where he cannot survey his Division all in one Day, if he happens to miss a Couch, When Comhas by reason of its being above Thirty Hours out, in this Case he must enter in his Book the true Number of Hours that

it has been out, and take a Gauge of fuch Corn, and enter the Dimensions in the Couch-Column, through which he must make a Dash, and so take a subsequent Gauge thereof; the Hours out, exceeding Thirty, shewing its Use, which is only for a Compare-Gauge. Since there have been many Instances of Malsters, who after the Officers have taken their CisternI.

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Gauges, have privately conveyed away the greatest Part of the Of removing Corn thus gauged from the Cistern, and supplied the same part of the Corn, with fresh Barley, covering the fresh Barley with Part of the Cittern with fresh Corn which was steeped before; the Officer must therefore use Barley. the best of his Skill by biting the Corn got from different How to be Depths of the Ciftern, or otherwise, to discover whether any guarded against.

The Colour of unfair Practice hath been used, which may in some Measure the Water to be be discovered by the Colour of the Water: But the Brass-observed. Receiver not answering the Intention of it, will afford him Receiver. no Satisfaction in this Matter, unless it be in speculative Gauging\*. And where he discovers any foul Practice, he must make a new Charge upon the Maliter, of so much Corn, as in Where fresh his Judgment hath been added to the Barley formerly charged added. by him. Now the Officer when he Gauges any Cistern, he Why the wet must observe the Dry as well as the wet Inches of such Cistern, and dry Inches and compare both with the real Depth of the faid Ciftern; the real Depth. by which means he will perceive whether any Bricks, Stones, Boards, or other things are put into the Cistern to hinder his coming at the Bottom of it: And where he finds any such practices are dif-Bricks, Stones, or other things, put into any Cistern, he must covered, the Colinform the Collector or Supervisor thereof, that they may pro- lector and Superinform the Collector or Supervisor thereof, that they may profecute the Offender for such Practices. Since from the Nature
of the Malsters Trade, they may have Occasion to work on Malsters to be
Sundays, the Officer must therefore in the Town he resides, before surveyed on Sunor after Divine Service, survey all the Malsters, and such
Malsters in the Country, from whom he has Reason to suspect the Excise

The Excise Year begin Very and where Frauds and unfair Practices. N. B. The Excise-Year begin-Year, and when rauds and untair Practices. W. B. The Buty- and it begins; of which ning the 24th of June, the Officer every Year before Midfum it begins; of which maliters are to mer, must inform each Malster in his Survey, that before he be acquainted, begins to make Malt the Year ensuing, he must make a new and why, Entry of all his Rooms, Cifterns, Kilns, and other Places and Utenfils, for the making and keeping of Malt; and if any Duty when Mal-Malster neglect so to do, the Officer must acquaint the Col-sters neglect lector therewith. But he must not leave off surveying such making Entries. Malster's House, unless he expressly declare to him, that he will not make Malt that Year; in which Case, he must immedi-ately enter such Declaration in the Body of his Book, and also off tureying among the Remarks for that Day in his Journal; after which, Malsters. he may leave off furveying at such House, but must carefully observe and inform himself the best he can, whether such Fraud, and how, Malster continues to make Malt notwitstanding his Declara- And may detion to the contrary. And if he has Proof, that he has done mand Entrance, fo, or has good Reason to believe it, he is to demand Entrance, in Order to survey his House as he does other Malsters And if he Houses; and if he is admitted, and finds any Malt making, discerns Fraud, he must immediately acquaint the Collector therewith, that the Collector. Malster may be prosecuted for making use of a Cistern, Floor, Esc. without giving legal Notice. But if he cannot get admittance He cannot get to enter and survey, he must by the first Post acquaint the Admittance,

Where fresh

The Officer's

When the Of-

<sup>\*</sup> Every Officer knows this, and yet the Expense of it is still enjoined.

Malt-house.

Board therewith; and he must send a particular Account of the Proof or Suspicion he has, that the Malster did make Must examine Malt contrary to his Declaration. The Officer must frequent-the Parcels of dry Barley in the ly examine the several Parcels of dry Barley in each Malthouse, and where he finds any sprinkled with Water, he may be fure 'tis a Preparation for unfair Practice, which by his

To eek for pri. Care and Diligence he may prevent and discover; and he must vate Cisterns, or from Time to Time, search after all private and concealed viz.

Cisterns or Vessels for steeping or keeping Barley, or other

Rooms for lay-Grain, and for Rooms or Places for laying Malt: and he must have a particular Care that no Fraud be carried on in ing Malt.

Of Barns, Soc. any Barn, or other Place adjoining to any Malt-house: and near the Malt- he must likewise be well satisfied that there is no Door covered like the Wall, no Range of Boards to be taken down, nor any Doors and Boards private Paffage whatfoever, out of the faid Malt-house into

to be taken down, any other Place; and upon finding any such, he must inform And private the Supervisor or Collector therewith, that they may lay an In-Paffages.

Must go thro' formation for the same against such Offenders. The Officer the Malt-house must take particular care, that upon each Survey he makes, that and all the enter- he goes quite through the Malt-house, and all the entered Rooms, to fee how many Floors there are, having a careful

Eye to each Parcel, and comparing the Condition thereof with Of new Wet. the Time out express'd in his Book; and he is also to observe ting laid between the old ones, nor the old ones, Soc. any Addition made by mixing from the Ciftern, or by Malt

brought from any private steeping Place.

He must observe, That when it happens that a Floor-Gauge Gauge will make of any Steeping is taken, which will make a better Charge the best Charge. than the Cistern or Couch-Gauges of the same, after making the respective Deductions or Allowances, which are Four in Twe ty for the Ciftern or Couch, and Ten in Towenty for the Floor; the amount of the best Cistern or Couch placed in the Column titled best, must be cancelled, or a Line drawn through the fame, to fignify that it does not make a Charge, but that the Charge arises from the Floor-Gauge, whose Content

The Method of must not in such Case be cancelled. The Way that is pracdiscovering when tifed for finding whether the Amount of the Ciftern or Couch ther the Account allowing Four in Twenty, that is \(\frac{1}{5}\) Part) or the Amount of the Cistern and (allowing Four in Twenty, that is \(\frac{1}{5}\) Part) or the Amount Couch or Floor of the Floor (allowing Ten in Twenty, that is, \(\frac{1}{2}\)) will make Guage, will make the best Charge, is this; multiply the Cistern or Couch-Bushels the best Charge. by 1.6, and the Product will be a Number of Figure Bushels, that are equal in Charge to those Cistern or Couch-Bulbels; but if you would find a Number of Couch or Ciflern-Bulbels, equal in Charge to any Number of Floor-Bufbels, multiply the Floor-Bushels by .625, and the Product will be the Number of Couch or Ciftern-Buthels, equal in Charge

to those Floor-Bushels.

The Officer must Mark every entered Room upon the Door thereof, or some other visible Part with 1, 2, 3, &c. with white Lead and Oyl, according to the Number that are

And private

When a Floor-

ther the Account

Must mark the entered Rooms.

entered in the whole: But he must let no Room be put into the \* Scheme under two Denominations, viz. it must not be included both in the Number of Rooms for working Malt, and in the Number for laying dry Barley or Malt, though it may happen to be used for both Purposes; for it must be his Endeavour that a greater Number of Rooms than are actually entered may not appear in the Scheme.

Concerning Malt-Compounders.

HE Officer must take notice, that at the next Sitting Of Compoun-Day, after each General Quarter-Day, he must bring ders. into his + Voucher, all the Compounders in his Division, men-Must enter the tioning their Names and Number of Heads, and charge them his Books, and in his Voucher with the Quarter's Composition; and at thehow. End of his Malt-Leidger, he must enter the Names of all the Compounders in his Division, with the Number of Heads in their respective Families compounded for, and he must trans-fer them from Book to Book, and from Time to Time, to ferred from Book inform himself whether there has been any Addition to their to Book, and why. Family fince the preceding Quarter; and if he finds any Addition made, he must give notice thereof to the Collec- Must apply to tor; and the Officer upon every Midsummer-Day, must go to the Compounders all the Compounders in his Division; and if they either to know if they have not, or do not then continue their Composition for Composition. the next Year, he must Gauge and take an Account of all When to pay the Malt which he can find in the Hands of, or belonging for Stock in to such Person, that was a Compounder for the last Year, and charge him with the Duty thereof; and from thenceforth, continue to survey and charge him with all the Malt he shall make for the future.

Concerning Cyder and Perry.

HE Officer must take notice, that all Persons whatso- Of Cyder and ever who buy Cyder or Perry for their own private Perry.

Use, (as well as such as are Retailers) are to pay the Duty That for priority of 4 s. per Hogshead, granted by the Malt Ast; excepting per Hogshead. Such as shall be used by Distillers for Distillation only. The Officer must likewise observe, that by a Clause in the Cyder and Perry, and Persons receiving great Quantities of Cyder to permit the Officer of their Custody, are to permit him to enter into ficer to take an the Places where such Cyder and Perry are kept: and upon their Resusal they incur the Penalty of 20 s. And he must carefully take an Account of the same, and Charge the Duty of Proprietor's own 4 s. per Hogshead upon so much thereof as the Proprietors Growth not shall not make appear to have been made of the Fruit of the chargeable. Proprietor's own Growth, and to keep Stock upon the Officer to keep stock upon the Officer to keep stock upon any of the Stock shall be sold, to charge such Stock upon it, or Part as was before charged with 4 s. per Hogshead, with the re-

<sup>\*</sup> Is an Account of a Division. † Is an Account of each Person's Charge, Sec. which the Pupil is made acquainted with when he is under Infructions.

tail Duty of 6 s. 8 d. per Horsbead more. And when any of that When to charge Part thereof which was made with Fruit, which was of the 4 s. per Hogi-Proprietor's own Growth, shall be fold to a Person who dees not retail it, he must Charge the Buyer thereof with the Duty of 4s. per Hogshead. And in case any of the said Cyder be sold to a Person that sells the same again, he must Charge such Cyder with the entire Duty of 10 s. 8 d. per Hogsbead; and When to charge in case the same, viz. such as has been charged with 4 s. only, 10 s. 8d. perHogf-shall not be fold but removed by the Proprietor, out of the

Division where the same was first taken an Account of, in When it is removed out of the order to be disposed of elsewhere, the Officer must give the Division for fale. Proprietor a Certificate, fignifying what Duty it has been charged with, before it was fo removed.

### CHAP. IV.

Concerning the Bufiness and Duty of those Officers of the Excise who survey Tanners, Tawers, Oyl-Dreffers and Parchment-Makers; so as to prevent their evading the Duty, or defrauding the Revenue.

How the Officer must be quali-

Of furveying Foot-walks.

Of furveying

HE Officer after he has qualified himself as directed in Page f, if he has a FOOT-WALK, he must survey every Tanner, Tawer, Oyl-Dresser, and Parchment-Maker, at least once a Day, and oftener if it is apprehended needful; and this he must do at uncertain Times, as a Means to

discover any unfair Practices. But if he has a RIDE, then he must consult with the Supervisor, what Place will be most proper for him to refide at, foas to make the best of those Branches of the Revenue as are under his Care and Inspection; and whatever Place it is which he refides at, he must survey that in all Respects as a Foot walk, and his Ride as often and in such

Manner as is directed in Page 19.

All Tanners, Sec. to give two Days Notice. walks.

These Notices to be filed.

Traders to make Entries.

The Officer must observe that all Tanvers, Oyl-Dreffers, Tanners, &c. must give Two Days Notice in Writing, of the Day and Hour of the Day, before they take any Hides, Skins, &c. out of the Wooze, &c. in order to be dried; unless Except in Foot-it be in Foot-walks, or those Yards which are surveyed every Day; here one Day's Notice for taking out or for marking will be allowed of as fufficient. And these Notices the Officer must put on a File at the Excise-Office kept for that Purpose; and the Traders \* must likewise make Entries of their Goods within Two Days after they are taken out; for which Purpose the Officer must leave a new Entry-Paper at each Trader's House, and the old ones must be carried to the Office; that at the Sitting the Supervisor or Collector may compare them with the

\* Tanners, Tawers, &c.

Book, and fwear the Traders or fuch proper Servants as they shall appoint: And all these Entries the Officer must put upon another File, and put a Blank Paper between each Round. But if any Tanner, Tawer, &c. does not take out Goods in When Traders order to dry, at or near the Time expressed in the Notice are to give fresh given, then such Tanner, Tawer, &c. is obliged to give a fresh notice. Notice, after the same Manner, as if no former Notice had been given by him. If the Officer, when he is upon his Survey, Account to be finds that any Calf's-Skins, Hides, Buts, or Backs, are nevely taken of Tale of taken out, he must be sure to take an Account of them by compared with Tale, and compare the same with the respective Person's Entry. the Entry. The Officer must also, as often as possible, take such other Goods by Tale as are newly taken out, and not, to excuse his Neglect, make a Pretence of his being otherwise employed, unless he really were fo. And in fuch Case he must immediately write over the fame Goods not examined. And as a Means to How to prevent check and prevent the Trader's carrying away any Hides, Frauds. Skins, Backs, or Buts, &c. which were dried, or were drying, before they are marked, and charged, and putting others in their Place, which have been privately taken out, he must frequently count the Number of fuch kinds of Hides, Skins, &c. and ob. ferve the Condition of them; and if he perceives that any are missing, or some of the same taken out which were almost dry'd, and others wet, he may then very justly suspect a Fraud. And in fuch Cases he must use his Endeavours to detect them, that Information may be laid for removing them before marked, or for taking out without giving Notice thereof. The Officer To be weighed must weigh and mark the Goods as foon as possible after the as soon after no Notice is shewn in the Journal, and he should frequently try vice as possible and examine the Weights and Scales one against another, and prove the Scales fee that they are just, before he offers to proceed to weigh; and mark each day and he must mark each Draught out of the Scales, and not the Scales. weigh two or more Draughts before he begins to mark them.

The Method of marking or flamping is as follows, which the How the dif-Officer must be careful to observe, viz. Hides, Buts and Backs, ferent sorts of must be marked on each Buttock; except Horse-Hides with the Leather are to be Hair on, and these must be marked on the Flank; tanned Cals-Skins, Hog-Skins, and Dog-Skins, must be marked above the Tail, and other Skins in the Neck; and the Officer must Note that no Leather is ever to be marked on the Flesh-side, that the Mark may be as plain and visible as possible after the Skins and Hides are pared, curried, &c. As often as he has an Opportunity, Must observe the Officer must observe the Marks upon Leather, whether they the Stamps are struck with a true or false Stamp, in which he will be afthe Custom-house fifted by these Remarks, viz. That the Stamps which are used Marks. in Scotland or North-Britain, are distinguished from those used in England, by having the Letters N, B; and the Stamps which are used at the Custom-bouse are distinguished from either of the other, by having the Letter I, which fignifies Import. The Officer must also take notice, that when Leather has

When Leather been stamped while it was wet, the Mark will always be forunk. has been stamped and not appear so large and fair as it does upon Leather that No. of fuch Mark, has been marked when it was dry; and when he finds any Leather that has been fo marked, he has cause to suspect that the Duty has not been regularly and fairly charged: because it is contrary to the Interest of the Trader to have his Leather weighed in fuch a Condition. And in fuch Case the Supervisor or Collector must be made acquainted with it; as also with the Number of the Stamp, that the Commissioners may have Knowledge of it, and prevent the like Practices for the future. What Care the Officer cannot be too careful of the Stamp wherewith he is in-

and not keeping separate from marked.

Officer ought to trusted, because if he loses it, he will be discharged; and to take of his Stamp. prevent any fraudulent Use being made of the Stamp, it is highly requifite that when he has not Occasion to carry it with him, that he keeps it fafely locked up, and intrust no Soul Of lessening the with the keeping of the Key but himself. There having been Weight of Hides repeated Instances of Tanners and others, who have impaired of removing or should their Skins contract to the first their Skins contract to the first their skins and the skins skins are the skins skins and the skins skins are the skins skins and the skins skins are the skins skins are the skins skins and the skins skins are the skins skins skins are the skins sk or shaved their Skins, contrary to Act of Parliament; and likewife that have not kept their Skins and Hides, which have not been duly marked, a-part and separate from their Skins and Hides that have been duly marked; or that have not for the Space of Twenty-four Hours in FOOT-WALKS, or of Forty-eight Hours in RIDES, next after fuch Goods are marked, kept them separate from those Goods which were of a former Marking, except they have been fooner re-weighed, or an Account taken of them by the Supervisor: In these or the like Cases, the Officer must give the Collector or Supervisor notice, that they may profecute such Offenders according to Law. The Tanners, &c. to Officer must f-wear Tanners, Tawers, and Oil-Dressers, to the

> those who are suspected of such Practices as often as he can, and if he meets with any Leather in the Currier's Possession,

> or if at any Fairs or Markets he finds any Leather unmarked,

and cannot receive Satisfaction that the Duty of it has been

Skins for Slinks; the Officer therefore, that he may not be

Skins

Must fwear the Value of those Value of their Goods, which are charged ad valorem, at the Goods that pay duty ad valorem, fame Time that he makes such Charges in his Book; and after he has figned those Affidavits, he must be careful to put

Of running wet them upon the Notice-File. It is easy to produce many In-Goods from the stances in which the Revenue has greatly suffered by running Currier's, and of wet Goods from the Tanner's to the Currier's, and also by priwashing Skins at wately washing Skins at the Oil-Mills; the Officer must therefore, to prevent such Practices, make cautionary Surveys upon

The stamped Leather, &c. to

charged, he must in either of those Cases make a Seizure of How Officers the fame. Some Traders have been frequently guilty of enterare imposed upon ing oil'd Deer Skins for Sheep and Lamb, and tanned Calf

Of the feveral imposed upon, must be careful and industrious in applying him-Kindsor Leather, felf to get a true Knowledge of the several Kinds of Leather, fo that he may be able to diffinguish one fort from another; and he must observe, that in all Lamb and Sheep Skins the Gash The Use of of the Knife will appear in the Shanks, but in Buck and Doe

observing the Shanks.

Skins the Shanks are smooth, by Reason they are cas'd and not flayed, as Lamb and Sheep are: And if he finds the Shanks In doubtful cut off, he has Reason to suspect a Fraud. And where the Cases make the Officer is doubtful, he must always make the best Charge, and best Charge. leave the Trader to discharge himself as he can. Note, That Of stamp'd Vel-Vellum and Parchment in the Custody of Distributers of the lum, and Rarch-Stamp-Office, and their Sub-distributers, not mark'd with the ment. Leather-stamp, the Officer is to let pass, as having paid the Duty of Vellum and Parchment; provided the same appears to an easy Method (which is approved of by the Commissioners) Method for charhave the Price Mark + of the Stamp-Office thereon. There is for the Officers expeditious charging the Duty on Pieces of ging the Duty on Horse-Hides, and other Hides, which are Tawed, and Pieces of Sa. Beaver-skins; and the Method is this. First, Of Beavers-skins: Weigh a middling Dozen, which we'll suppose weighs 20 Pounds, and enter 20 in his Book on the Top of the Leaf in the proper Column, and this will be a fix'd Divisor, to find out the Dozen and odd Skins, which are contained in a Parcel of Pieces of Beaver Skins: As for Example: A Number of Pieces of Beaver weigh 895 Pounds, this being divided by 20, the Weight of a middling Dozen, it brings out 44 Dozen 9 Skins to be charged in the Officer's Book. Secondly. Let us suppose, for Example, the 895 Pounds to be the Weight of a Number of Pieces of Horse-Hides Tawed, and the Divisor 20 Pound to be the Weight of a middling Horse Hide, then must the Officer's Charge be 443 of Horse-Hides. Thirdly. For Example, let us suppose the 895 Pounds, to be the Weight of a Number of Pieces of other Hides Tawed; if you divide it by 40, which we'll suppose to be the Weight of one other middling Hide, then the Officer must charge 22 \frac{1}{3} of other Hides. I think this is very plain, but lest I should not be understood, I shall fet down the Working of the Examples above.

1. Pieces of Bea-	2. Pieces of Horse- Hides.	3. Pieces of other Hides.
20)895(44 <sup>3</sup> 80	20)895(44 <sup>3</sup> 80	40(895(22 <sup>1</sup> / <sub>3</sub> ) 80
	-	
95 80	95 80	95 80
Equal to 44 Doz. 9 Skin	s. Equal to 44\frac{3}{4} H	ides.

Because I believe it may be useful to many, I shall here set down a Description of those several Sorts of Leather that are made Use of for Upper-Leather, or Sole-Leather, which do not retain

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<sup>†</sup> This Mark is made with Ink, and usually placed below the Stamp, to shew the Price of the Parchment exclusive of the Stamp. Such Skins as are regularly prized at the Office, have a Crown at the Top of this Mark, which Skins prized elsewhere always want.

Of Sole-Lea-

Of Upper Les- retain the Name of the Hide or Skin from whence they are taken; but upon their being cut into particular Forms, acquire Roundings, Wombs, Rands, new Names. I. Such of these as are made Use of for Mysand Offals.

New Names. I. Such of these as are made Use of for Mysand Offals. per-Leather, are known by the several Names of Dibbings, Roundings, Wombs, Rands and Offals: The Offal, is only the thin Part of fuch Hides as the Bends and Clout-Leather are cut from, i. e. The Belly, Flank, and Shank of the Hide; and these are frequently cut into several Pieces, and tanned for Upper Leathers. The Offal Part of the Hide is most frequently met with in remote Collections, in some of which they are alfo known by the Name of Roundings, in others by the Name of Heads, Dibbings, and Wombs. II. Of fuch as are made use of for Sole-Leather, and are diftinguished by the several ther called Crop Names of Crop-Soles, Bends, Clout-Leather, Butts and Backs. Crop-Soles are cut out of the Back of a good fout Upper-Leather-Hide, after 'tis tanned. 1. Bende are what are cut out of the best Part of the Hide, i. e. out of the Back, Ribs, Buttocks, and Shoulders, and into more or less Pieces, frequently from Six to Ten Bends, according as the Custom of the Country requires; and then they are tanned in the same Manner as Butts and Backs, which I shall describe below. 2. Clout-Leather, is only a smaller Sort of Bends; the best Part of the Hide being cut into 20 or 30 Pieces, which is cured differently from Bends, Backs or Butts, (which are immediately hung up to dry when taken out of the Wooze:) but Clout-Leather, when it is sufficiently tanned, is laid in an Hole, covered with Horsedung, which gives the Leather, when it becomes dry, an extraordinary Hardness and a black Colour: This fort of Leather is very common in the West of England, viz at Exeter, &c. 3. Butts most commonly are made from the largest Ox, Bull, Steer or Cow Hides; and those are tanned whole, after the Pates and Tails are cut off, which are tanned feparately: The Hides thus tanned, are for the most Part called Butts, yet in fome Places they call them Bends, viz. at Briftol, Southamp-

Clout-Leather what.

Bends what.

Butts what.

Backs what.

and Tails.

fort, there may appear 11 Sides of Leather taken out; which Of the Pates in the Officers Books are express'd 5 Backs. The Pates and Tails of these, as well as of the Butts, are cut from these Hides and tanned separately. N. B. That all the other Sorts of Goods, which are either Tawed, Tanned, or Dress'd in Oil, are distinguished by the Kind or Species that produces them.

ton, and thereabouts. 4. Baths are as usually made from small Hides, as from large ones, which for the Conveniencies in Tanning and Packing afterwards, are cut down the Back into two Parts; and hence it is, that in taking an Account of this

- A Compendious Table shewing the Total Rates, to be paid for Hides, Skins, &c. that are dress in Oil, Taw'd or Tann'd in Great Britain; which will be very useful both to the Officer and Trader.
  - 1. Skins, Hides, &c. which are DRESS'D IN OIL.

		1.	. 5.	d.
SHEEP and Lamb	at	0	0	3 per Pound
Deer		0	0	6 per Pound
Goat and Beaver — — Calf-Skins — —	· –	0	0	8 per Pound
Skins and Pieces, &c. ad Va- lorem at 15 per Cent and also at	5	0	0	2 per Pound

2. Skins, Hides, &c which are TAWED.

Sheep and Lamb	_	-	at	9	0	1 per Pound
Calves and Kipps	-					1 per Pound
Buck and Doe	-	-	at	0	0	6 per Pound
Calve Slink without	Hair, D	og and	Kid	0	1	o per Dozen
Beaver and Goat	-		at	0	2	o per Dozen
Calve Slink with Ha	ir —	-	at	0	3	o per Dozen
Horse Hides -	-	-	at	0	I	6 per Hide
All other Hides -	-	_	at	0	3	o per Hide
Skins and Pieces, &	c. ad V	a lorem	at :	30	0	o per Cent.

3. Skins, Hides, &c. which are TANNED.

Sheep and Lamb — —	)			
Butts and Backs — — — — — — — — — — — — — — — — — — —	- at	0	0	1 to per Pound
Calves and Kipps — —				
Hogs and Dogs — —	)			
Roans — — —	at	0	0	2 per Pound
Goats Tann'd with Shomack	at	0	0	4 per Pound
Skins and Pieces, &c. ad Valorem	at	30	0	o per Cent.
Parchment — —				6 per Dozen
Vellum	at			o per Dozen

To fave the Officer and Trader the Trouble of computing the Amount of the Duty of those Goods which pay Duty ad Valorem, after the Rates of 15 l. and 30 l. per Cent. I have calculated the two following Tables.

New Tables at A Table at 15 per Cent. ad Vo- A Table at 30 per Cent. ad Va15 and 30 per C. lorem, per C. Leadbetter. lorem per C. Leadbetter.

						-4		p .		-					
Val	ue	D	uty is	V	ing d.	D	uty is	V	alue	D	uty is	Va	lue	D	uty is
beir	g .		,	De	ing,		,	Ь	eing .			bei	ng ,		,
Is.	d.	5	. d.	15.	d.	5	· a.	5.	a.	5.	d.	5.	d.	S.	d.
0	5	0	$0\frac{3}{4} \\ 1\frac{1}{2} \\ 2\frac{1}{4}$	10	5 10 3 8	I	03	0	21/2	0 0	$0\frac{3}{4}$ $1\frac{1}{2}$ $2\frac{1}{4}$	5 5 5 5 6 6 6 6 6 6	21/2 5,72 10 01/2 3,52 8 10/2 1	1	63
0	10	0	1 1/2	11	10	1	$7\frac{1}{2}$	0 0 0	5	0	$I\frac{1}{2}$	5	5	I I	72
1	3	000	24	11	3	I	81/4	0	71/2	0	24	5	72	1	81/4
1		0	3 3 4 1 2 1 4 5 6 6 3 4 1 2 1 5 4 7 8 4	11 12 12	8	1	9	0	10	0	3 3 <sup>3</sup> 4 4 <sup>1</sup> 2 5 <sup>1</sup> 4 6 3 <sup>3</sup> 4 7 <sup>1</sup> 2 8 <sup>1</sup> 4	5	10	1	9
2	6	0	34	12	6	I	94		0,1	00000	334	6	01	I I	94
2	6	C	42	12	6	I	102	I I I I 2 2 2	3	0	42	6	3	1	IC2
2	11	0	54	12		1	114	I	51	0	54	6	52	I	114
3	4	0	6	13	4	2	0	I	8	0	6	6	8	2	C
1 3	9	0	63	13	9		03	1	01/2	0	63		102	2	C 3/4
14	2	0	72	13 14 14 15 15 16 16	4 9 2 7 0 5 10 3 8 1 6	2	0 0 3 4 1 1 2 2 1 4	2	I '	0	7=	7 7 7 7 7 8 8 8 8 8	1	2	$1\frac{1}{2}$
4	7	0	8-4	14	7	2	24	2	32	00	81	7	31/2	2	21/4
15	0	0	9	15	0	2.	3		6	0	9	7	6	2	3
5	5	0	9 9 <sup>3</sup> / <sub>4</sub> 10 <sup>1</sup> / <sub>7</sub> 11 <sup>1</sup> / <sub>4</sub>	15	5	2	34	2	81	0	9 9 <sup>3</sup> / <sub>4</sub> 10 <sup>1</sup> / <sub>2</sub> 11 <sup>1</sup> / <sub>4</sub>	7	8	2	34
5	10	0	102	15	10	2	41	2	11		101	7	11	2	42
6	3	0	114	16	3	2	54	3	11/2	0		8	1 1/2	2	54
6	8	1	0		8	2	0	3	4	1	0	8	4	2	6
17	1	1	03	17 17 17 18	1	2	03	3	61	1	03	8	$6\frac{1}{2}$	2	63
1.7	6	1	1-2	17	6	2	71/2	3	9	1	11/2	8	9	2	7=
17	11	1	2-4	17	11	2	87	3	1112	I	24	8	I 1 1 2	2	81
8	4	I	3	118	4	2	9	4	2	I	3	9	2	2	9
s. 0 0 1 1 2 2 2 2 3 3 4 4 5 5 5 5 6 6 7 7 7 8 8 9 9 10	6 11 4 9 2 7 0 5 10 3 8 1 6 11 4 9 2 7 0	1	0 0 0 1 1 2 1 4 3 3 4 4 2 5 6	18	9	2 2 2 2 2 2 2 3	3 3 4 1 2 1 4 5 6 5 7 8 1 4 1 1 1 1 4 1 1 1 1 1 1 1 1 1 1 1 1	2 2 3 3 3 3 3 4 4 4 4 5	4 6½ 9 11½ 2 4½ 7 9½	I	0 0 0 1 1 2 4 3 3 4 4 2 1 4 1 5 6	999	3 <sup>1</sup> / <sub>2</sub> 6 8 <sup>1</sup> / <sub>2</sub> 11 1 <sup>1</sup> / <sub>2</sub> 4 6 <sup>1</sup> / <sub>2</sub> 9 11 <sup>1</sup> / <sub>2</sub> 2 4 7 9 <sup>1</sup> / <sub>2</sub> 9	2 2 2 2 2 2 2 2 2 3	d. 6347614 9 9 10 11 1 0 0 1 1 2 3 3 4 1 2 1 4 5 6 6 7 8 1 9 10 11 14 14 14 14 14 14 14 14 14 14 14 14
9	2	I	42	19	2	2	101	4	7	1	42	9	7	2	101
9	7	1	54	19	7	2	114	4	91	I	154	9	92	2	114
10	0	1	6	20	0	3	10 1	5	0 1	I	6	10	0	3	0

### CHAP. V.

Concerning the Business and Duty of those Officers of the Excise who survey Soapmakers, so as to prevent their evading the Duty or defrauding the Revenue.

EFORE I treat of the Duty of the Officer. I think it will be requisite to give him some Infight into the Way and Method of making

the feveral Kinds of Soap. The principal Ingredients which are used

in making all Sorts of Soap, are Lyes drawn from Ashes or Lime, boiled up with Tallow or Oil, or both. The different Ways of making the feveral Sorts of fost Soap are various, and the Time that is required to bring it to Perfection somewhat uncertain; but it commonly takes up Part of Two Days, and when 'tis boiled

how Soap is made. Various Sorts

Of what and

of foft Scap.

enough, it is put into Casks. The Method of making of Ball Soap, what, Ball-Soap (which is commonly used in the North) is this : and how made. The Lyes are put into the Copper, and boiled about 24 Hours, until the Waterish Part be quite gone, and nothing but a fort of nitrous Matter (which is the very Strength or Essence of the Lye) remaining; to which the Tallow is put, and the Copper kept boiling and stirring for above half an Hour; in or about which Time the Soap is made; and then 'tis put out of the Copper, into Tubs or Baskets with Sheets in them; and immediately while it is fost, it is made into Balls. Hard Soap Hard Soap how is generally boiled at twice; the first of which is called an made. Half-boil what. balf-boil; and before that Operation is perfected, the Lyes Graining what. are separated from the Tallowish Part by Salt, which is called Graining; then the Copper is charged again with fresh Lyes, which with the first Half-Boil, is boiled until it be grained as in the first Half-Boil; after which, the Soap is taken Is hardened in out of the Copper and put into a Frame to cool and harden. Frame. It has been frequently experienced, that a Boiling of Hard Soap hath been made at one Operation, especially where Frauds in mak-Frauds are intended; in which Case, nevertheless, the Makers Frauds in mak-pretend, that it is only Half-boil and imperfect, yet in the Absence of the Officer carry away all or Part thereof, and before his Return, bring fresh Lyes and Tallow to such a Forwardness in the Pan or Copper, as to be taken for the pretended Half-boil under the fecond Operation. It is also well known, that it hath been a frequent Practice, after perfect Soap hath been put into the Frame, and the Officer has taken an Account of it, to take a Part thereof out, and then by Other Frauds adding hot Lyes to the Remainder, bring the Soap up to the by adding fresh fame Depth and Quantity as it was before: For which Reason, if the Officer observes that any fresh Lyes are heating in any Pan or Copper, while the Soap is bot, or newly put into the Frame, a Fraud may reasonably be suspected, and by a sudden Return discovered. There have been frequent Instances Other Frauds where Soap-makers have brought Half boil, to be put into the by pretending Pan or Copper, and new made, under pretence of its being Half-boi Wet-bottoms, Cuttings, or Scrapings of fram'd Soap, and as fuch have demanded an Allowance: But fuch unfair Practices, may probably be prevented or discovered by the two Obser- Nice Observavations following, viz. First. Soap, if it be strong, will be verytions for prevent-thick, and what is taken up near the Lyes will be bright, and ing Frauds. have a Grain like a Peafe; and if squeezed betwixt the Fingers, will shine, and scale if bended; and such Soap being put into the Frame, and no Lyes put to it afterwards, will fling the Tongue, if touch'd with it. Secondly. But if Soap be weak, 'twill have a faint Smell; and the Body will be thin, and it will either have no Grain, or what is very small and pale, and if squeez'd as above, will feel greasy; it will be soft because not boiled to a real Body, and dull and not fmooth, because not purified with the second Lyes.

Or Foot-walks.

The Officer who has a Foot-Walk must survey every Soaphouse in his Division once in fix Hours, or oftner, when the Soap-maker is at Work; and he should never less than t-vice a Day when filent: and it is most adviseable that it be done as early in the Morning, and as late at Night as possible. But if he has received a Notice for working, or finds any Preparation for Work, or he suspect any Fraud in any of these Cases, he must be more frequent in his Surveys. The Officer that has a RIDE must furvey the Soap-makers as often as possible on uncertain Days, and at uncertain Times of the Day, when there is not a Notice depending: but if he has a Notice for working, he must contrive his Surveys to be at such Times as may best prevent or detect Frauds: especially, let him endeavour to survey about the Time of finishing, and he should stay if his other Bufiness will permit till the Soap is struck off.

No Soapmaker make without

Of Rides.

Take Notice, that no Soap-maker must begin to make or work upthe Officer on any making of Soap of any Sort or Kind whatfover, nor put Hours Notice: any Lees or Lye into the Copper or Pan for the making Soap, without giving to the Officer of the Division where such Soap is to be made, Notice in Writing of the particular Time and Hour, And if he does when fuch making is intended to be begun, 24 Hours before

or begin in 12 fuch Beginning of every fuch making: But, in case such in-Hours after the tended making of Soap shall not be begun to be work d up-

fach Notice, on, and to be actually making within twelve Hours after the he Notice to be Time mentioned in the Notice, that Notice is woid, and the work and a new Soap-maker must not begin to make or work upon such making, without giving a new or other like Notice as aforesaid. Notice must be But if a bard-Soap boiler does not intend to go on with his fe-

he fecond Boil. cond-Boil, as foon as he has finished his first balf-boil: the Officer is to require him to mention in his Notice, the Time when he intends to begin to work on his fecond-Boil, and if he does not go on with his Second-Boil according to the Time mentioned in that Notice, he must give a new Notice in the Manner before mentioned; such Second-Boil being in the In-Must take the tention of the Law, a beginning to work. Now when the Of-

Notice in, &c. ficer receives a Notice for working, he must immediately en-What such En-ter it on his Book, 1. The Time when he read it. 2. try must setforth. The Person's Name who sign'd it. 3. The Time of their

beginning to work, and put the Notice on a File for that How the Offi- End and Purpose. It is highly requisite, that where the cer may guard a Officer meets with a Making of Soft-Soap lying upon the Damp, either knitting, or immediately before it be cleanfed into the Casks, he should take the dry Inches, of the Copper, at some fixt or remarkable Place thereof, and enter the same in his Book, in order to discover whether any Part thereof hath been conveyed away, before his succeeding Visit; or to make an Estimate from the Produce of some preceding Boilings, what any fucceeding Boiling will be; and where the Dif-

Must enter the parity is considerable, a Fraud may be suspected. The Ofwand mark it ficer before 'tis boiled off, must take and enter the exact Tare e

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of

of each Cask upon it, and also enter the said Tare at the End And attend of his Book, and give necessary Attendance at the emptying whilst emptying out of the Copi it out of the Copper; inserting in his Book the Numbers and per. What a Barrels Sizes of each Sort of Casks, which are, or ought to be, Bar-What a Bariel, rels, Half-Barrels, Firkins, or Half-Firkins; each Barrel con-kin of Soap containing 256 lb. and the Firkin 64 lb. Averdupois, befides the tains.

Weight or Tare of the Cask. Then as to Ball-Soap, the Officuring the Duty on Ballchiefest Security of the Duty depends upon a due Attendance Soap. larly required to be present at the Time of its being fruck be weighed. Returning Soap out of the Copper, and also at the Time of Tallowing, and into the Copper, to continue there 'till it is fruck off; and to weigh the fame, upon Pretence of before it is made into Balls. By all means the Officer keeping it warm. must take care that the Soap-Boilers do not impose upon him, by returning Soap not throughly Tallowed, into the Copper, if it has been weighed, under a Pretence of keeping it warm, and afterwards add fresh Tallow to it; and therefore in order to should make fudprevent the Soap-Boilers fo doing, the Officer should as often den Returns. as possible, make a fudden Return after he has weighed it. And should at-The Officer, if it be possible, should always be at the House Cleansing of hard before they begin the Cleansing of bard Soap, and attend till Soap, &c. it is all put into the Frame. Also it is very necessary, at the At the coming of off of a Boilto expension of the source of off of a Boilto expension of the source of the source of off of a Boilto expension of the source of coming off of any Sort of Soap, to inspect in a more parti-amine the House cular manner the enter'd Parts of the House, and where the Officers suspects a Fraud, such other Parts; as may be useful for that Purpose. When any Boiling of Soap is to be and Weights.

weighed off, great Care should be taken, that the Weights and To observe the Scales are just; also it should be observed from the Surface of Surface of the the Soap, or otherwise, whether any Part of the Boiling hath Soap in the Frame been diminished; and where the Weight of bard-Soap comes the Weight and short of the fram'd Gauge, one Pound in Ten, or in Propor the FrameGauge, tion thereto, he may reasonably suspect a Fraud, and in such Cases make the Charge from the Frame Gauge. It will be expected from the Officer, where he can attend the cutting up of a Boiling of Soap, that he enters down in his Book, the Number of Pieces into which it is cut (provided the same be not weighed off before he departs the House;) which he must have a strict Regard to, upon the Weighing; and enter the particular Number against each Draught; but he must at all Times endeavour to weigh it off in Slabs before it be cut into with the cubical small Pieces like Bricks; and this for a Reason which I need Inchesina Pound, not suggest. N. B. That the Cubical Inches contained in a Pound and Divisor for of hard Soap, are 27.14, which Number is the common Divisor, for square and circulare Measure, and 5.2 the Gauge Point on the Rule; and 34.55 the Gauge Point the Divisor for circular Measure, 5.878 will be the Gauge Point on Of Green Soft the sliding Rule. N. B. That the Cube Inches in a Pound of Green cal Inches in a soft Soap are 25.67, and 5.07 the Gauge Point; so that 32.68 Pound, and Divisorill be a common Divisor in all circular Measure, and 5.716 the for for circular will be a common Divisor in all circular Measure, and 5.716 the for for circular Measure, and the Gauge Point on the Rule for this Sort. N.B. That the Cube Gauge Point Inches in a Pound of white Soft Soap are 25.56, and 5.05 Part II.

The Officer

Of the Scales

the Gauge Point; therefore 32.54 will be a common Di-Of White Soft vifor in all circular Measure, and 5.704 the Gauge Point Soap, with cubi-on the sliding Rule. The Officer, when any Soap-cal Inches in a maker offers to return into the Copper, decayed, rotten, or Pound, and Di-Cuttime and Scaptings of good Soap round, and Di-vifor for circular Cuttings and Scrapings of good Soap, to be refresh'd and new Measure, and the made; I say, on these Occasions, the Officer is to endeavour Gauge Point. by the best Means he can to discover when by the best Means he can, to discover whether it is Soap, or

an Half-boil only intended to be imposed upon him as Soap; and if Soap, whether the Duty hath been paid or charged for the fame; and if he cannot receive full Satisfaction therein, he is to make no Allowance in respect thereof. . Nor is he to make Allowance for any Soap returned into the Copper, except the Soap-maker has given him Notice in Writing of his Intention to return such Soap 24 Hours before the time of putting the same into the Copper; and assoon as any such Notice is given, the Officer must enter it in his Book, under his last Survey, and put the Notice on a File; and if the Supervisor be in Town, he is to be informed, that he may see the same returned; but in case the Supervisor cannot be applied to, or cannot attend, and there be any other Officer (or Officers) who reside in the same Town, the proper Officer should give Notice to such Officer, (or to such of the Officers as can best attend;) that he as well as the proper Of-

The Supervitor ficer, may fee the Soap weighed, put into the Copper and ficer, must be pre-melted down: and the Supervisor, or the Officer who fees it refent with the pro-turned, must fign the proper Officer's Books, to attest or witness per Officer to see the Soap return.

## CHAP. VI.

Concerning the Business and Duty of those Officers of the Excise who survey Tallow Chandlers in the Country, fo as to prevent their evading the Duty, and defrauding the Revenue.

Chandlers obliged to make Entries.

Duty of the Office-keeper and Officer.

VERY Chandler or Maker of Candles, except Compounders, are to make true and particular Entries of their Workbouses, Storebouses, Utenfils, &c. every fix Weeks, and the Officer is to take care to see that the Office-keepers, when

they receive such Entries, do immediately write upon each Entry, the Day of the Month, and the Year of our Lord when they receive them, and fign their Names thereto, and put them upon a File, which must be carefully lock'd up, and the Officer is from Time to Time, as such Entries are made, to copy the same into a Book for that Purpose, and those Copies are to be attested by the Office-keeper,

Immediately to and as foon as possible after any such Entry is made, and corepair to the Performance, the Officer is to require the Person such made it, to show

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him every Melting-bouse, Work-house, Ware-house, Store-bouse, Shop-Room, or other Place, and also every Copper, Kettle, Pot Mould, or other Vessel or Utenfil expressed therein; and the Officer must insert in his Entry Book, the Situation of all those Places, and mark the Particulars in such Manner, as may enable him, or the Supervisor, or any other, readily to find the fame.

The Foot Officer must survey every Chandler in his Divi- When Foot-sion, at least once in fix Hours, when at Work, and never vey Chandlers. less than twice a Day when filent; but oftner where any Fraud is suspected; and these Visits must be as early in the Morning, and as late at Night as possible; and it is requisite that the Officer should sometimes survey such as have made their Declarations, between the Time of his receiving those Declarations, and the Hour declared for Beginning; however he must not exceed three Hours after the Time declared, that he may discover whether the Chandler begins before or within three Hours after the Time mentioned in his Declaration.

Riding-Officers must survey their Chandlers in Rides on un- Riding Officers certain Days, and at uncertain Times of the Day; sometimes as to survey Chandearly in the Mornings, and fometimes as late in the Evenings lers early and late as possible; and as often as he can, twice in a Day when he Hours

has a Declaration depending.

All Tallow-Chandlers, or those who make Candles for Sale, before they begin to everk upon, dip, or make any Course, or making of Candles, or light any Fire under any Copper, Kettle, or other Utenfil, for the Melting Tallow, or other Materials for the making Candles, or spread any Rushes, or Cottons, are obliged to make and deliver (or cause to be made and delivered) to the Officer in whose Survey they are, a Declaration in Writing, containing,

1. A True Account of the Number of Sticks of which such

making is intended to consist.

2. An Account of the Sizes, and true Number of Candles Entry. intended to be made on each Stick.

3. The particular Hour and Time of the Day or Night auben

such Course or Making is intended to be begun.

And if the Making or Course of Candles shall not be begun, or proceeded upon, at the Hour and Time mentioned in fuch Declaration, or in three Hours next after that Time, then the faid Declaration is to be void.

N. B. But if fuch Course or Making, is intended to be of Of the Entry of mould Candles, the Maker shall declare to the Officer, before Mould Candles. he begins to fill any of the faid Moulds, bow many Moulds he intends to fill, and how often he intends to draw the faid Moulds at fuch Making. 13 Wherever the Officer has Reason from any Circumstance, to suspect unfair Mould Candless Practices, and observes any considerable Difference in the Forwardness of a Making of Candles, or in any particular Size therein, viz. as some of them to be made about \(\frac{1}{4}\), when

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Of Frauds my

Methods to prevent Frauds.

others are but 1, in fuch Case he must, by such Characters, denote the Difference against fuch Stick, and make quick Returns, upon such Chandler, in order to prevent or discover any unfair Practice, by carrying off those Sticks and Candles that are near finished, and supplying their Place by others privately brought in: And in this case, the Officer should frequently look through all Parts of the House, or other Place, that may be convenient for carrying on fuch Frauds; especially, such Places as have been entered, and he must observe, the Condition the Copper and Mould are in, whether they are warm or not : He should also take Notice of the Colour, or Condition of the Candles in Stock, and also the Size of them, in order to find out if the Chandler has a greater Quantity of any Size than has been charged upon him. The Officer should likewise make Observation concerning the Stock of Tallow, and the Condition of the Tubs wherein it lies, that he may discover if any be missing between his Surveys; and what elfe he thinks may be of use to discover whether the Officer to de- Chandler works fairly or otherwise. Assoon as the Officer fire the Candles to finds a Making of Candles finished, he must desire to have as made, or make them weighed, if in a Condition for it; but if not, he must take an Estimate of them, by trying a Pound or other small Quantity of each Size, and he must enter the Sizes according

an Estimate.

how to be guarded against.

Collector and Supervisor to be acquainted when Candles are mif-

To fee the justed.

To guard aainit unfair cales and Weights.

Other Frauds to what he finds them to be by fuch Estimate; and he is to cast up that Estimate, if he finds any of the Sizes different from the Chandler's Declaration, or his own former Account. If they are not different from, but agreeable to what was entered before in his Book, then he need not be at the Trouble to cast it up. The Officer must be careful to return in due time, to weigh the Candles, and enter the feveral Draughts in his Book, as he weighs them; and he ought to compare the whole with the Chandler's Declaration, and if he observes any of the Sticks or Candles to be missing, from a former Account, he must then charge so much as such Candles so misfing may reasonably be supposed to weigh, and acquaint the Collector and Supervisor therewith; it being the Collector's Province to fee that an Information be laid, for fraudulently removing them before they are weighed, and if he suspects that the Sizes differ from the Declaration, he must weigh each Size separately. The Officer ought to be very careful before Tare of the Frame or Frame, Baskets, he begins to weigh any Making that the Tare of the Frame or and Rods well ad-Basket on which the Candles are hung, be truly ballanced, or else that the Tare thereof be exactly adjusted, and entered in his Book, before he fets down any Draught; and if he does not ballance the Rods on which the Candles are made, with a like Number of other Rods, he must deduct the Tare of the Rods,

as well as the Tare of the Frame out of every Draught before

he puts it down, and he ought to be very careful that he is not

imposed upon by false Scales, or Weights, or by counter-ballancing

those Sticks whereon the Candles are, with others that are of a

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much greater Weight. When it so happens that Candles are How the Duty crack'd and spoil'd, in making, and the Chandler intends to have is to be allowed them defaced, and the Duty allowed him for the same, the Offi-dles. cer must at the Time of Weighing the Making of which such crack'd Candles are a Part, take Notice in his Book, by a Memorandum, that Part of the Candles of fuch Making are crack'd, and he must also enter an Estimate as near as he can, of the Quantity that are so crack'd, and defire the Chandler to keep them till the Supervisor comes, who must examine them, and if he has good and sufficient Reason to believe, that they are Duty as to such only as were crack'd and spoil'd in making, he is to weigh crack'd Candles. and see them utterly defaced, that no part thereof may be left in a Condition to be burned, and the Supervisor is to certify in the Officer's Books, the Quantity defaced, and for fuch and no other, is the Chandler to have an Allowance out of the next Candles he makes. It is highly requisite, where any making of Candles is depending in the Town the Officer refides, and are not like to be which are not likly to be finished till late at Night, that he con-finished till late trives his Surveys, fo as not to fail taking an Account of them at Night. that Night, by Estimation, or Weight, after they are finished, and fee that the Mould is drawn, and Fire from under the Copper. And where the Officer suspects any Chandlers to commit Frauds, he ought to survey them once or oftner on a Sunday. It is the Business of an Officer to be careful to keep the Chandler up to their Declarations, and to all other Parts of their Duty, be kept up to and when he observes that they neglect, or refuse to perform their Dury. the same, or when he discovers any Fraud, he must acquaint the Collector or Supervisor therewith; for it is their Province to fee that the Offender is profecuted according to Law. Not- How to proceed withflanding the Imprudence some have formerly been guilty when the Chandof, I'm inclined to believe there are none now, who are subject ler refuses to adto this Duty, fo stupid as to refuse the King's Officer free Ingress and Regress; yet, since 'tis possible that to cover a Fraud, he may fometimes be denied Admittance, I shall here set down how his Duty requires he should proceed when it is refused him. The Officer when he demands Admittance or Entrance at, or into, any Chandler's, &c. he must first for a reasonable Time, Ring, Call, or Knock, at the Chandler's Gate or Dwelling House, or such other Place where he has before usually procured Entrance, and if he be not admitted upon so doing, he must with a plain and audible Voice, make a Demand at the faid Gate, Dwelling House, or other Place, in Words to the following Effect, viz. " I to the following Effect, viz. " I Gauger, The Form of a or Officer of Excise, do demand Entrance into the Work-Demand of Adto furyey, or take Account of his When the Of-" house of Mr. " Candles according to Law." And if the Demand be ficer is to demand made between the Hours of Eleven in the Evening, and Five Admittance in the Mountains it must be in the Presence of a Constally and the Presence of in the Morning, it must be in the Presence of a Constable, and Constable. he is to mention in his Demand, that a Constable is with him; but if the Demand be made between Five in the Morning, and

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Starch is made. How long a

Lawn-Sive.

fermenting.

Eleven in the Evening, though at fuch Time he may demand Entrance without a Constable, yet he ought, if possible, to have A Witness Should be present some sufficient Witness present, to prove his demanding Entrance as aforefaid; and after he has fo done, he is to flay a reademanded. fonable Time, before he goes away from the House or Place, and must enter the whole of his Proceedings in his Book; and if it is

or his Servant to possible for him to do it, he should when he is denied Entrance, The Chandler be warned of the acquaint the Chandler or his Servant, with the Danger of such Penalty incurred Behaviour, and the Penalty incurred by such Refusal.

## CHAP. VII.

Concerning the Business and Duty of those Officers of the Excise who survey Starch-Makers, so far as to enable them to understand the Nature of that Manufacture, and to prevent the Maker from evading the Duty or defrauding the Revenue.

EFORE I treat of the Duty of the Officer, I I think it highly requifite to inform him of the Way and Method of making STARCH, which is as follows.

> 1. When Wheat is ground, the Meal of it is put into a large Fat, and then Water is put to it,

where it lies and Ferments from feven to fourteen Days, according as the Season of the Year keeps it back, or forwards its Operation.

It fettles to the Bottom, the Wa-2. When it hath had sufficient Fermentation, it will settle to the Bottom of the Fat; and then the Water being drawn or ter drawn off. The Meal put taken from it, the Meal is discharged from the Fat into a into fresh Water, Tub, and there, as it is put into the Tub, it is stirred up with

And frained, fres Water, and then strained through a Hair-Sive, (to separate the course Bran from it) into several other Tubs, where it Settles to the commonly lies two Days, in which Time, not being disturbed,

the Meal will fettle to the Bottom. Bottom.

3. When the Water is taken from it, and it is again stirred up in fresh Water, 'tis strained through a Lazun-Sive into other Tubs, where when it has lain about two Days more, and undisurbed, it will again settle to the Bottom, and be fit to be taken out of the Tubs and put into the Boxes, (the Place fet Is put into the forth by Law for its being gauged in) where in about ten Hours and upwards, it will be dreined, and grow fomewhat bard.

4. Then it is turned out of the Boxes, and broke into feveral Is then laid to Pieces, and laid upon Bricks for that Purpote, fet Edge-ways, in Sheds to dry, where it commonly lies about two Days.

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5. It is then taken down and put into the Stove, where in Is put into the the Space of a Day or two, it will come to a Crust, i. e. be stove and crusted, the Space of a Day or two, it will come to a Crust, i. e. be and put into the covered with a hard Substance, which being scraped off, and Stove again bethe inward Part again put into the Stove, it will in about two comes Days more Grain, or become what we call Starch fit for fale. and fit for fale. Now for the Duty and Bufiness of the Officer.

The Officer must be careful that all Starch-Makers in his Officer's Entries, Survey, make true and particular Entries as the Law requires, which must be which are to be kept on a File by the Office-Keeper; and he is kept by the from time to time to enter Copies of all such Entries into a Must survey Book by him kept for that Purpose, which the Office-Keeper is the Makers.

The Officer must be careful to survey his Starch. When they Makers every Day, and when the Meal is fo forward in Ope-must be surveyed ration, that it hath passed a second straining in the Tubs, he Day. must survey them two or three Times a Day, till he hath taken an Account of the whole Making by Gauge in the Boxes; and when it is near dry'd off in the Stoves, he must make the like

furvey, until it is weighed off.

The Officer must be careful to Number and Gauge all the All the Vessels Starch-Makers Fats and Boxes, entering their Lengths and and Boxes to be Breadths in his Dimension-Book, which he must keep for that Purpose, and constantly carry it about with him; so that when any Box is filled, he may have nothing to do but take the Depth, and enter the other Dimensions from his said Book. In every furvey, the Offier must enter the Condition of the Fats, tion of the Fat. and when it hath had its full Fermentation, and is settled to the Bottom, he must (having taken feveral Depths) enter the of the Depths en-Mean or Medium of those Depths in the Fat Column, which tered and cast up. he is to cast up by the Area, computing Twenty-five Pounds of Pounds of Starch Starch, for every Bushel of Meal; and if he finds this to ad-to a Bushel of vance his other Accounts confiderably, from Boxes and Weight, Meal, &c. he must charge from it; but if not, he must make his Charge from the best of the others. The Officer in the next Survey he makes after the Meal is out of the Fat, is to give an Account of the Number of Tubs it hath been strained into (call'd Sour Water Tubs) entring them in the proper Column, and in every subse- Tubs to be enquent Survey he makes (while it lies there) he must continue the tered. fame Account, and when it hath been strained thence, through the Lawn-Sive into the Tubs (called Green-Starch-Tubs) he the Lawn-Sive into the Tubs (called Green-Starch-Tubs) he And No. of must in every Survey take an Account of the Numbers, and Green Starch enter them, and if in any of the subsequent Surveys he misseth Tubs. any Tub or Tubs, that had been fettled from the Lawn-Sive, suspecting Frauds or were near being fettled in his preceding Survey, or shall find any Tub or Tubs altered from a fettled to a disturbed or unsettled Condition, (which will not naturally happen) and have no Account of any filled into the Boxes; he may justly suspect from thence the Maker has been at some unfair Practice, either by sbifting the Boxes or having Boxes privately dreining, which he must be very careful to discover, by Search or otherwise; and if after fuch Search, he is not able to find any thing, nor

Of the Condi-

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Muft take an exact Account of

the Boxes. The Division for reducing green Starch to dry Starch.

When the Of- receive Satisfaction how that Miss or Alteration happened, he ficer may charge may from his own Judgment, charge as the Law directs in to the best of his The Officer in every Survey must take an exact that Cafe. Account of the Boxes he finds filled with Green Starch, by gauging them, and entring the Length, Breadth, and Depth of each Box; and having found the folid Content in Inches, he must divide the said Content by 40.714, and 6.38 will be the Gauge Point on the Sliding-Rule, the folid Inches and Parts, contained in a Quantity of Green Starch, which the Law has esteemed to produce a Pound of dry Starch perfectly made, and the Quotient will be the Number of Pounds of dry Starch, which he is to charge from each Box.

Note, It has been found that 40.714, are the cubical Inches The Divisor in contained in a Quantity of Green Starch, that is esteemed to produce a Pound of dry Starch, and confequently 51.84, will be a common Divisor in all circular Measure, and its Root 7.2,

will be the Gauge Point on the Sliding Rule.

The Officer must be very watchful of the Stoves, when he finds the Starch is near dry'd off, returning often upon them; and if his other Business will admit of it, he must clap in upon them towards the latter End of the Drying, and fee the And when dry'd and notwithstanding the Law hath impowered him to make weigh it before a Charge by Gauge in the Boxes; yet he must never omit Making dry'd off, and weigh it before he leaves the House; a Charge by Gauge in the Boxes; yet he must never omit weighing the dry'd Starch; which if the Starch-Maker works fair, will be much the better Charge. He must also be careful that the Scales are truly ballanced, and the Weights Good, and he must weigh to the Truth; he must not upon any Pretence of Cuftom, be induced to strike a Pound or more in each Draught: Having weighed the Starch, he must enter the Draughts as he proceeds.

circular Measure. The Gauge

Point. Must keep a friet Eye over the Stoves.

Must never Strike a Pound for the turn of the Scale at each Draught.

### CHAP. VIII.

Concerning the Duty and Business of those Officers of Excise who survey Hops, so as to prevent the Planters from evading the Duty, or defrauding the Revenue.

foun as Entry is made, must go and see the Plan-

Entries to be copied.

S foon as the Planters have made their Entry of their Hop Grounds, the Officer must go to every one of them, and by furveying endeavour to difcover whether the Number and Parts of Acres agree with the Entry of fuch Planters, and he

must enter the Number and Parts of Juch Acres at the top of his Hop-Leidger, distinguishing those of a latter Growth, from those that are come to Perfection. The Officer is from time to time to copy out all Entries made by the Hop-Planters into a Book for that Purpose, in which he is never to The Control of the Control

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exceed five Days, under a Penalty in case of Neglect. The Of Planters when ficer must survey every House once a Day until they begin to to be surveyed. Pick, after which time, and until they have done Bagging and Weighing, he must survey them twice a Day, if the other Branches of the Revenue he is concerned in will permit. If the Officer when he is on his Survey, has notice given him of the time when any Planter defigns to bag and weigh, he must immediately enter it in the Body of his Minute-Book, and also at the End Planter's notice thereof; and from thence post it into his Journal. The Officer immediately. must attend the Bagging of all Hops where his Time will permit; the bagging, Sc. and if he cannot get them weighed at the Time of Bagging, he must enter the Number of Bags unweighed in the proper Column of his Minute-Book; but he must not on any Pretence neglect to of his Minute-Book; but he must not on any Presence neglect to fee them weighed if proper notice be given, and in the Weighing he must be very exact; not only in seeing that the Scales are gainst falle Scales
truly ballanced, but also in taking care that the Weights are true; Must get the
he must get the best Weight of each Bag that he can, and no best Weight he
Custom of the Country is to be any Plea for his stricking a can.
Pound or two for each Draught. When he has weighed a Bag Tare of the
and deducted the Tare, he must enter the Number of the Bag, Bags to be deand against it the Gross and net Weight in their proper Columns
to be numbered
in his Minute-Book, marking the Number and net Weight upon and marked. in his Minute-Book, marking the Number and net Weight upon and marked each Bag, with the Year of our Lord, and also the total Amount weighed at that Time. In order to prevent any Frauds that may be committed by a false Beam, the Officer must frequently exchange the Ends, by putting the Weights sometimes into one End, and sometimes into the other. Note, The Officer must Bags how to be Mark every Bag of Hops cross the Sewing at the Top, and also marked. at the Bottom if it be fewed there; fo that in case the Bag be opened after 'tis weighed and marked, and more Hops put in, the Fraud may appear by the Mark being separated.

The Officer when he has notice from a Planter of the Time Of notice of he intends to bag, he must go to his Oust and civilly defire to bagging. know how long he will be in bagging, and when it is that he intends to weigh, that he may attend and perform his Duty; and When he canif in case he finds that so many Planters intend to weigh at the not attendall the same Time, that he cannot be present at every Place, he must endeavour to persuade some of them to alter the Time they have pointed; but in case he cannot prevail, then he must forthwith give notice to the Supervisor, or neighbouring Officer, that the Planters may be duly attended. The Officer must leave a Speci- A Specimen men in the first Oust of every Planter, wherein he must enter Paper to be lest, the Date of his Survey, with other Remarks. The Officer must the Officer before he leaves his Division, deliver to each Planter, the Total must deliver each of each Charge he has made upon him, with the Amount in Planter the Total Money, and the Place where, and Time when such Duty is to of his Charge, be paid, and to fign his Name thereto, that no Person may in Money, and plead Ignorance of it.

when and where the Duty must be

Must enter the

Must attend

CHAP. Paid.

### CHAP. IX.

Concerning the Business and Duty of those Officers of the Excise, who survey Paper-Makers, so far as to enable them to understand the Nature of that Manufacture; and to prevent the Makers from evading the Duty or defrauding the Revenue.

EFORE I treat of the Duty of the Officer, I think it is requifite to inform him of the Way or Method of making Paper, which is as follows. The different Kinds of Paper are made either

The feveral of Rags, Cables, or Ropes, &c. and Writing or Printing Paper is made of the finer Rags; and Sorts of what and how Paper is

Ordinary or Brown Paper of the coarse Rags, Ropes, Cables, &c. When the Rags are sorted and swalp d, they are put into Of the Hammers Troughs call'd Mortars, each Mortar having to it five Hamof Mortars. mers: In these Mortars the Rags are beaten into what is call'd

Of Half-Stuff, and then they are laid to mellow in Tubs, Bians or Chefts, in some Part of the Mill, or Corner of the Out-house; when they are fufficiently mellow'd, they are put into the Mortars again, and beaten until made into fine-Stuff; and they are

In the Mill there is a Vessel then fit to be made into Paper. call'd a Fat, but more properly a Copper, because there is a Fire kept under it; and into this Fat, the Stuff that is so beaten is put to a sufficient Quantity of Water, and kept to a certain Degree of Heat, about lukewarm, and this is the last Prepara-

Of the Moulds, tion for making Paper. There are Moulds to answer each Size of Paper defign'd to be made, and the Bottom of each Mould is of Brass Wire, somewhat resembling a fine Sive; and those Moulds are dipt into the Fat, and are so handled by the Dex-

terity and Skill of the Workman, that the Water runs through the Wires of the Mould, and the beaten Stuff only remains behind therein; and then it is gently turn'd out of the Mould and Of the Felt, laid on a Woollen Cloath, which is call'd a Felt, and when it is laid on the Felt, it appears as a perfect Sheet of Paper; then another Felt is laid upon that Sheet, and again another Sheet

upon that Felt, and so on till they have rais'd a Heap of feven or eight Quires, which is call'd a Poft. Note, that each Post ge-A Post of Pa-nerally contains the fame Number of Quires, as there are Reams

intended to be made that Day: But some Workmen will make but five Quires in a Post, and then he makes 28, or 30 Posts in Of the pressing a Day, which makes the same Quantity. The Post being put

into a Press, and press'd very hard together, till the Water is squeez'd out; it is not suffer'd to continue in the Press, but its immediately taken out again, and the Sheets of Paper being ta-

Of drying the ken from betwixt the Felts, are laid one upon the other till the vext Day, and then are hung up on Lines call'd Trebles, in the Drying.

and Mortars.

Marin Spaces

Lastra St. W

S.garagad a.b

Of Fine-Stuff. Of the Fats.

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Drying-House, in Parcels of three, four, or five Sheets in each Parcel; they have no certain Time of hanging, but in Winter Time taken up they hang much longer than in the Summer. As foon as the drying or fizing. Sheets are dry they are taken down again, and are flatted and laid in Piles, and then fixed, that is, they are wetted in fixe; after that when the Quantity of several Reams has been put one upon another, they are pressed again, leaving a sufficient Quantity of fize therein for the bearing of Ink when wrote upon. Af-Time ter this they are hung to dry a fecond Time in Parcels of 3 or 4 Sheets at the most, and when they are dry again, they are taken down from the Lines and forted, when the Sheets which are Of Sorting. broken and faulty are separated from the Good, and both count. ed into Quires: After this is done, they are pressed 2 or 3 Times till made smooth, and then ty'd up into Reams or Bundles for What is a Note, That 18 of the good Quires and 2 of the broken go Ream and what a to each Ream, and 36 of the Good and 4 of the Broken to each Bundle of Paper. Bundle. N. B. Brown and whited brown Paper are made after Of brown and the same Method, but they are sooner finished, because but once per. hung up to dry before pressed and made up into Reams or Bundles for the Market.

Having described to the Officer the Manner of making Paper,
I shall furnish him with 3 very useful Tables, and then conclude this Chapter with such Cautions and Instructions, as are ful Tables.

requifite to advance that Branch of the Revenue.



### The First TABLE.

A Table of the Names and Dimensions (i.e. the Length and Breadth of each Sheet) of those forts of Papers, that are usu-Names, Sizes, ally made in England, and also the Quantity of each fort that is Sec. of Paper, commonly reckoned a Day's Work.

NAMES of Paper.	Dimensions or Length and Breadth of each Sheet.	How many Reams of each Sort usually made in a day.
BROWN PAPERS.		North Basic Commence Apple the
Large Cap, called Bagg Cap -	23 by 19	6
Kentish Cap — — —	21½ by 18	61/3
Western Cap	201 by 171	7
Small Ordinary	18 by 15	71
Ditto 2 Pound — — —	22 by 14	7 1 Ream makes a Bundle.
Ditto 1 Pound double -	18 by 111	7 r Ream makes a Bundle.
Ditto 1 Pound double -	19 by 15 1	71 I Ream makes Two Bundles.
WHITED BROWN.	I Washington	
Called Lomb. Hand -	21 by 17	63
Royal — — —		61
Middle French -		$6\frac{1}{3}$
Small French		7
Middle Hand		
Small Hand —	18 by 141	7 8
Cut Hand—		7 1 Ream makes a Bundia
PRINTING SUPER ROYAL	231 by 23	4
Printing Royal -		5
Royal Blue		5
Cartridge Paper		5
Printing Demy		7
Writing Demy	19 by 154	7
Denty Blue — —	193 by 153	7
Large Post	19 by 143	7
Crown	184 by 144	87.
Printing Fools Cap -	THE RESERVE OF SHIP SHIP SHIP SHIP SHIP SHIP SHIP SHIP	8 In some Mills they make nine Reams in a Day.
Writing Fools Cap -		87
Fan Paper large	221 by 141	7
Fan Paper Small -		8.
Chancery double		7
Bastard or double Copy	19 by 143	
Pot	151 by 121	8 In some Mills nine in a Day.

N. B. Notwithstanding the Length and Breadth of Paper are not exactly the same in every Mill, yet the Difference is so very little, that they may be easily known from other Sorts.

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Here follow the Names and Rates (as set forth in the Acts of Parliament) of the several Sorts of Paper which are made in Acts of Parliament of the several Sorts of Paper which are made in Acts of Parliament of the Honourable Commissioners of Excise.

	,		. ,	
	1.	s.	d.	
Demy Fine	-0	2	3	1
Demy fecond — — — —	-0	1	0	1
Crown Fine-	-0	1	6	
Crown fecond — — —	-0	1	11	
Fools Cap Fine — — —	-0	1	6	1
Fools Cap second	-0	1	11	Sper Ream.
Fine Pot -	0	1	6	
Second Pot	-0	0	9	
Brown large Cap	->	0	9	
Small ordinary brown	-0	0	6	j
Whited brown — — —	0	0	9	per Bundle.
Paste-boards, Mill-boards and Scale-	0	4	6	per C. Wt.
Printed, Painted, or Stained Paper for Hangings — — 5	0	0	11/2	p.yd Square

ALL OTHER Papers White or Brown, or of any other Cobur or Kind, pay a Duty of 18 1. per Cent ad Valorem.



### The Third TABLE.

A Table at 18 l. A Table of 18 l. per Cent. ad Valorem for Officers and Paper-makers, calculated per C. Leadbetter.

The Value	being The Duty is	The Value	being T	he D	ity is
0 0 1	1 0 0 01	1. s. 0 10 0 10 0 11 0 11 0 12	0 0	0 I 0 I 0 2	d. 9½ 1034 1134 034 2
0 0 5	1 001	0 12 0 13 0 13 0 14 0 14	6 6 6	2 2 2 2 2 2 2	3 4 5 4 5 4 7 4 7
0 0 7	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0 15 0 15 0 16 0 16 0 17	0 6 6 6	2 2 2 2	8½ 9½ 10½ 11¾ 0¾
0 0 9	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0 17 0 18 0 18 0 19 0 19	6 6	3 3 3 3 3	134 3 4 5 64
0 0 11 0 1 0 0 2 0 0 3 0 0 4 0	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	01 0 02 0 03 0 04 0 05 0	0 0	3 7 7 10 14	74 21 21 21 21 44 0
0 5 0 0 6 0 0 7 0 0 8 0 0 9 0	0 1 1	06 0 07 0 08 0 09 0 10 0	0 1	5 8 12	7 <sup>1</sup> / <sub>4</sub> 2 <sup>1</sup> / <sub>2</sub> 9 <sup>1</sup> / <sub>4</sub> 9 <sup>1</sup> / <sub>4</sub> 0

### Directions for the Officers.

How Papermakers are to be furveyed. HE Officer must be careful to survey the Paper-makers in Town at least twice a Day, and in his Ride once a Day; contriving his Surveys so as to be there sometimes wery early in

the Morning, and fometimes very late at Night; and he must fettle his Residence in such Part of the Ride, that he may easily furyey them at uncertain Times, unless Business of greater Confequence requires him to refide elsewhere. In dispatch of Business it is impracticable to require a Tale of the several Sorts of ticable to count Paper in Operation in each Survey; and besides, it is the Custom the several sorts in the Paper Trade, for Work-men to know their Day's Work, in Operation. by the usual Quantity of each Sort of Paper required to be made in a Day: And what these usual Quantities are, I have informed Of a Day's the Officer in Page 44; the Officer is therefore from the constant Work. See Table Work of the Mortars, to expect Stuffenough to employ the Fat The Mortars to or Fats, which he must in every Survey enter in its proper Co-keep the Fat suplumn; i. e. how many Mortars are going, and from each Fat to plied. Of a Day's Work. expect a Day's Work, which is most commonly finished in about 12 Hours, and enter the Sort of Paper they have been at work upon in the proper Fat-Column; and that the Officer may not be imposed upon by the Paper-makers, I have furnished him in Page 45 with a Description of the several Sorts of Paper, which are usually made in England. In every Survey the Offi- Must go thre' cer must go through the several entered Drying Rooms, and other the Drying-Places of the Mill and Houses, and sometimes by counting the Rooms, Orc. last Day's Work, and at other Times by counting the Posts, 20 count the last of which are commonly reckoned a Day's Work; he may readily Day's Work, and fatisfy himself that more Paper is not made in a Day, than is usuthe Posts.

ally reckoned a Day's Work: But in case he finds there is, he has Must look nargood Reason to suspect them, and is therefore to be very care-rowly after that ful to look after that Sort of Paper when 'tis near finish'd. The fort where he sufthe Sorting-houses, and Ware-houses, and compare the Largeness of Eye over Sorting-the Piles with what they were upon, with his preceding Survey; Houses, Sec. usual in the finishing Part; for from this and such other Observations as he shall be able to make, he may discover whether they work fair or not.

The Officer must upon taking Account of the Paper when finished, in order to make a Charge, examine some of the Reams Charge. and Bundles of each fort, to discover whether they have not imposed upon him, either in the Tale of Quires or Sheets. The To be careful as to making En-Officer must be careful that all the Paper-makers in his Survey, tries. make true and particular Entries according to Law, which must be carefully kept on a File by the Office-keeper; and the Officer must from time to time enter Copies of all such Entries in a Book kept by him for that Purpose, which the Office-keeper is to fign when requested. In no case whatever must the Officer Of feigned surenter any fsigned Surveys, nor erafe, alter or blot out any Word, veys, nor must be Figure or Character, newithstanding he finds he were mistaken; any Figure, O.c. but he must write a Memorandum of it in Words at Length; nor must he offer to take out nor Change any Leaves in his Book; and against the Sitting, he must have his Voucher and Abstract ready for the Collector. A Specimen-Paper must be kept by the Offi-

'Tis not prac-

Making his

cer in every Paper-maker's Finishing-house, wherein he mult enter the Date of his Survey; and when he makes a Charge on any Sort or Sorts of Paper, he must enter the Quanity of each Sort he has charged thereon.

### CHAP. X.

Of the Duty and Business of those Officers of Excise, who survey Printers of Silk, Linen, &c. so as to prevent the Printers from evading the Duty and defrauding the Revenue.

Printers when to be furveyed.

Officers must go thro' all the en-tered Rooms, &c.

And when he miles any to Charge the Duty for them.

How to meafure and stamp them, and enter them in the Speeimen Paper.

Yard for meafuring to be di-vided into 100 equal Parts.

The Use of

HE Officer employed in this Branch of the Revenue, must survey the Printers or others, who are chargeable with these Duties, as often as his other Business will admit of it; and every Survey he makes; he must gothrough all the Entered Rooms; and into fuch other Places which are not entered.

that he apprehends may be convenient for laying, preparing, working, drying or keeping any of the faid Commodities. He must be careful to take and keep the best Account he can, of all Linens, Silks, &c. that shall be brought in to be printed, &c. and if in his future Surveys he shall miss any Quantity of Linens, Silks, &c. whereof he had an Account, he must charge the same according as the Law directs. The Officer when he has made his Survey, must measure all he finds printed, and enter the Length; Breadth and Content of every Piece in his Book, in its proper Column. stamping them as he proceeds; and before he goes out of the House, he must enter in the Specimen kept there for that Purpose, which is to be a Copy of his Book, the Length, Breadth, and Content of every Piece he has charged in his Survey.

Now in order to render the Measuring in these Duties as concise and practicable as possible, the Officer must provide himself with a Rule exactly a Yard long; which must be divided into 10 equal Parts, and those again divided into 10 other equal Parts, will make the whole Yard to be equally divided into 100 equal Parts; with which Yard he must take his Lengths and Breadths,

Of Length and and enter them in Yards and Parts of Yards. For Instance, if a Breadth. An Ex-Piece be 18 Yards and 1 long, and 3 of a Yard broad, the Length by the Rule will be 18.5, the Breadth .75, which being multithe Sliding Rule plied the Length by the Breadth, the Product will be the Content n casting up the in Yards Square, and Parts. But by the Sliding Rule its much Of Callicoes readier, for fetting the Length 18.5, on B, to Unity on A, from 31 1/2 Inches against the Breadth .75 on A, you have 13.875 the Content on B. Note, That all Callicoes which are above 31 Inches and are

to 40 1 Broad. Of Callicoes of half broad and under 40 Inches and a half, are to be accounted greater or leffer for as Yard broad; and all other Callicoes of a greater or lefs Breadth, all Linens, and all Silk-Handkerchiefs are to be account-

Breadth, &c. Of all other

ed for by the Yard Square; and so in Proportion for a greater All other Silks or less Quantity. In all other Silks the Officer must reckon the Yard Square to the Yard Square for Two Yards, and so on in Proportion. be recked the Yards The Officer is to take Notice: 1st, that all printed Silks, Callicoes, Linens, &c. are to be measured and stamp'd as soon as he finds them finish'd; let them be wet, drying or dry. adly, That painted Silks are to be measur'd and stamp'd as When to be measured foon as he finds any Design, or Pattern, hath been printed fured and stamp'd, upon them. 3dly, That dyed Silks Handkerchiefs, Callicoes, Linens, &c. are to be taken account of as to the Number of Pieces whilft drying, but it feems impracticable to measure and stamp them 'till dry'd off.

### CHAP. XI.

Of the Drawback on SOAP, employed in making of Cloths, &c. and of making up the Accounts for the Manufacturers to obtain it with the Forms of the Affidavits \* required by Law.



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LL So AP spent, employ'd, or consum'd in mak-Soap spent in maing Clothes, Serges, Kersies, Bays, Stockings, or any other Manufactures made of Sheep, or Lambs Wool, or in preparing the Wool for the same, or in whitening new Linen in the Piece on Oath ing Clothes, Serges, Kerfies, Bays, Stockings, or king Cloths, &c. any other Manufactures made of Sheep, or Lambs to have a Draw-

or Apprecation of the Workman is intituled to a Drawback.

And one Pound of Soap is allowed to scour, or wash twenty One Pound of Soap to 20 Pound Pounds of Worfted Yarn. Also balf a Pound of Soap is allowed to scour one Piece of Bu- of Worsted Yarn,

rying Crape made of Sheep or Lambs Wool in England; and of Soap to a Piece that for every Dozen Pounds of Soap thus used, there shall be of Crape.

a Drawback of the Duty of 10 d. to every Dealer.

Now in making up of any Scourer of Worsteds Accompt, Instructions for in order to have the Drawback, if they are unacquainted making up those with it, and therefore have not had any Allowance, but be-Accompts. ing informed of it, would have Accompts drawn up for that purpose; they must propose some certain limited Time, allowing some Quantity of Soap used each Week, or else, a Quantity of Worsted, or Pieces of aurought Woollen every Week, and then by the Proportions and following Work their Accompts may

Example 1. Suppose a Scourer has used two Pounds of Soap An Example. per Week, and his Accompt is of eight Years standing, how must this Accompt be stated?

PART II. See

It is not required that these Affidavits should be on Stang-Paper, and for the writing them the Officer is to take 4 d, and no more.

Operation.

See the Work.

Weeks. Day. Hours.
One Year is 52 1 6

365 Days.

730

8766 Hours in a Year. 8 Years.

24)70128(2922(417 Weeks and 3 Days.

Days. 2 Pounds of Soap used each Week.

834 Pounds of Soap used in eight Years.

Now to find the Pounds of Worsted used in eight Years according to Law.

Soap. Worsted. Soap Pounds.
lb. lb. lb.
If 1 is to 20, so is 834

The Form of an Affidavit.

Answer 16680 Pounds of Worsted.

The Form of the Affidavit, is this.

From May 19, 1728, to May 16, 1736, inclusive.

I William Asley, Weaver, living in Gravel-Lane in the Parish of St. Botolph's Aldgate, London, make Oath, that I have used Eight Hundred and Thirty-sour Pounds of British Soap, in scouring of Sixteen Thousand, Six Hundred, and Eighty Pounds of Worsled made of Sheep or Lambs Wool, at Gravel-Lane abovesaid, from May 19, 1728, to May 16, 1736, inclusive, for which I have had no Allowance according to Act of Parliament in that Behalf made.

21. 17s. 11d.

WILLIAM ASLEY.

How to money it. To money this (or any other of this Kind) this is the Work.

1b. d. lb.

If 12 is to 10, fo is 834

10

12)20) l. s. d.

12)8340(695(57(2 17 11.

Pence.

Answer 2 17 11.

Example.

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6, d-

Example II. If I have 16680 Pounds of Worsted Yarn, Example 2. how many Pounds of Soap will they take to fcour them?

Operation.

See the Work. Soap. 16. Worfted. If 20 is to 1, so is 16680

20) 16680 (834 Pounds of Soap.

The Form of an Affidavit for Pieces of Burying Crape.

An Affidavit for Burying Crapes,

From Sept. 3, 1735, to Jan. 6, 1735, inclusive.

I Thomas Neson, Weaver, living at the Sign of the Crown in Hollywell-Lane in the Parish of St Leonard's Shoreditch, in the County of Middlesex, make Oath, that I have used Seven Hundred and Ten Pounds of British Soap, in scouring of One Thousand four Hundred and twenty Pieces of Burying Crape, made of Sheeps or Lambs Wool, at Hollywell-Lane abovefaid, from Sept. 3, 1735, to Jan. 6, 1735, inclusive, for which I have had no Allowance according to Act of Parliament in that Behalf made.

21. 91. 3 d. 23q.

THOMAS NESOM.

N.B. If the Workman move from one Place to another, in What to be obthe Time for which the Entry is made, he must mention each serv'd if the particular Quantity of Soap used at each separate Place of his Workman has re-Abode.

### CHAP. XII.

Containing a Gauger's Commission; a Scheme of a Division; a Voucher, and Abstract for Beer, Ale and Cyder; a Voucher and Abstract for Malt and Cyder; with their Indorfements.

The Form of a Gauger's Commission.

The Form of an Excifeman's Com-



Dall to whom these Presents shall come, greet-mission. ing, know pe, that we whose Hands and Seals are bereunto set, being the major Part of the chief By a Majority of Commissioners and Governors for the Management the Commissioners. of the Receipt of the Excise, that is to say, the

Duties upon making and importing Beer, Ale, and other Ex-Ale and Beer, &c. ciseable Liquors in England, Wales, and Berwick upon Tweed, and upon making Malt, and upon making and importing Mum, Malt. Cyder, and Perry respectively, within the before-mentioned Li- Mum, St. immits, and of the Duties upon making Candles, and of the Du ported.

Hope.

ties upon Hops growing and to grow in England, Wales, and Berwick upon Tweed; and we also being the major Part of the Commissioners for the Receipt and Management of the several and respective Duties berein after mentioned, within the LA mits aforesaid, (that is to say,) of the several and respective Scap, Paper, &c. Duties upon making of Soap, Paper, Pastboard, Milboard, and Scaleboard respectively, and upon Printing, Painting, or

Silks, Callicoes, Gold Wire, &c.

Leather, &c. Parchment. Plate.

Reasons for appointing the Officer.

Appointment of the Officer:

Malt exported. Coffee, Tea, &c. unlawfully imported.

Impower'd to gauge, measure, weigh, &c.

And must enter his Books.

Paper stain'd, &c. Staining of Paper, and upon Printing, Painting, Staining, or Dying of Silks, Callicoes, Linens, and Stuffs respectively, and upon Making of Starch, and of Gilt and Silver Wire respectively, and upon Tanning, Tawing, or Dreffing of Hides and Skins, and Pieces of Hides and Skins, and upon Making of Vellom and Parchment respectively, and upon Silver Plate and Manufactures of Silver respectively, and of the Inland Duties upon Coffee, Tea, &c. Coffee, Tea, and Chocolate respectively, arisen or accrued, or to rise or accrue in England, Wales, and Town of Berwick upon Tweed, reposing especial Fust and Considence in the Knowledge, Skill, Industry, Integrity, Fidelity, and Circumspection of Charles Leadbetter, Gentleman, habe (pursuant to the several and respective Powers, given and granted in and by the several and respective Statutes relating to the said several and respective Duties, and in and by our several and respective Commissions and Constitutions) nominated, constituted, and appointed, and for hi: Majesty's Service, do nominate, constitute, him the said Charles Leadbetter, to be one of the Surveyors, Messengers, Gaugers, and Officers of and for the said several and respective Duties before-mentioned, all and every of them respectively, and of all other Duties, that shall or may be put under the Management of us the said present Commissioners, or of the like Commissioners for the Time being, and for the measuring and attending Malt that shall be shipp'd for Exportation, and for the Seizing of all Coffee, Tea, Chocolate, and Cocoa Nuts, as shall be unlawfully imported, or carried within the Limits aforesaid: And do hereby impower and require him the faid Charles Leadbetter, that pursuant to the Powers and Authorities, in and by the faid several and respective Statutes relating to the said several and respective Duties, he shall, and do, from Time to Time, by gauging, measuring, weighing, and otherwise take, and also do enter into a Book and Books, to be true Accompts in from Time to Time delivered to him for that Purpose, full and true Accounts of the Quantities, Qualities, Natures, and Kinds

of all and every the several and respective Goods, Commodities, and Manufactures respectively chargeable with, and liable to, the said several and respective Duties, which he from Time to Time, shall, or may find out or discover, and thereof respectively And from Time Shall and do, from Time to Time, make and deliver to us, the the Commissioners, present Commissioners, and to the Commissioners for the said Duties for the Time being, or to the major Part of us, or them refpettively, or to fuch as we, or the major Part of us have ap-

pointed, or as we, or the Commissioners for the said Duties for

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the Time being, or the major Part of us or them respectively, Or the Major Part Shall nominate or appoint for such Purpose, full and true Re- of them in Writurns, Reports, Vouchers, and Accounts in Writing, of the full ting. and true Quantities, Qualities, Natures, and Kinds, of all Of the Quantity, and every the said several and respective Goods, Commodities, Quality, &c. and Manufactures before-mentioned, chargeable with or liable Of the Goods lito the said several and respective Duties, by him from Time able to the Duties. to Time found out or discovered: And that he shall and do exercise, execute, and perform, all and every the Powers and Authorities, in and by the several and respective Statutes given and granted, or enacted to be done, exercised, executed, and performed by such Surveyor, Messenger, Gauger, or Officer, according to the true Intent and Meaning of such Statutes respectively. To hold, exercise, execute, and perform, the said To hold his Office Office of such Surveyor or Messenger, Gauger and Officer, as during Pleasure. aforesaid, during the Pleasure of us the said present Commissioners, and during the like Pleasure of the Commissioners for the said Duties for the Time being, or of the major Part of us respectively. And all Justices of the Peace, Mayors, Sheriffs, Justices, &c. re-Bailiffs, and other Magistrates, and also all Constables, Head-quired to assist the boroughs, and other Officers of the Peace, and other Person or Officer in Execu-Persons what soever, are hereby prayed and required to be aid-tion of his Office. ing and assisting unto him the said Charles Leadbeater in the due Execution hereof, as they will answer the Contrary at their utmost Peril. Stoen under our Hands and Seals, at the chief Office of Excise and for the said Duties, in London, this Day of in the Year of the Reign of Our Sovereign Lord GEORGE, the Grace of God, of Great-Britain, France, and Ireland, King, Defender of the Faith, &c. Annoque Domini, 17-

N.B. The Commission is always signed and sealed by (sive) a Majority of the Commissioners.



# A Scheme of a Division. Part II.

A SCHEME of Bromfgrove 2d. O. R. 17--

N.B. The Officer is always to insert a Scheme of his Division in the Front of his Books, except the Dimension Book.

Places Names.	Miles.	Victuallers.	Malfters.	Pap, Mill.	Candle M.	Soap M.	Starch M.	Hop Plant.	Tanners.	Tawers.
Redditch Foxlidiat, Bently Heath Hollick, Hewel Tardibig Duff-House Gambles Hollow-Tree Burcott Stoney Lane Cobley-Hill Upper Forge Home	2   I   I	1 5	I	1	1			] [] 1	1	7
SHORT Round -	18	13	6	1	1			5	1	
Rownigreen Alchurch Lickey, Rofe and Crown - Rednall Green Holly Hill Long Bridge Norfield West Heath Kingsnorton Webb Heath Wetherick Hill Beely Home	$ \begin{array}{c c}  & I \\  & 2 \\  & I_{\frac{1}{2}}^{\frac{1}{2}} \\  & 4 \\  & I_{\frac{1}{2}}^{\frac{1}{2}} \end{array} $	4   1   1   1   2	2 I I I I I I I	I		1				
LONG Round	28 18 <del>3</del>	16	6	1	1	1		5	1	
Total -	46 <del>3</del>	29	2	2	1	1	-	5	1	1

Fitz Lambe, Supervisor. Charles Leadbetter, Officer.

The Officers must write their Christian Name at Length.

N.B. What further relates to the above Scheme will be found at the End of the Explanation of the Dimension Book, page \*55.

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# A SPECIMEN of a DIMENSION-BOOK.

#### Richard Ballamy.

30 M.T.	Ar.	32.5 Cop.	Ar.	Under Back.	1	Coolers.	3	Ö	Dp.33.5	Ar.	Dp. 30	. A
43.2	6.2 5.9 5.5	38.2 32.2 30.4	4.07 3.07 2.57	L. 114 B. 81 A.32.7	25 174	1,29	25.4 1.80	T. 38.6 C. 29.4 A. 3.16	33.5 34.3 32.3	3.12 3.27 2.90	43.2	5.2 4.9 4.6
40.7	5:5 j	30.4	2.57	A.32.7	174	; 1,29 ;	1.80	A. 3. 16	; 32.3	2.90	40.7	4.6

No	H.	B.	L.	Cont.	Nº	H.	В.	L.	Cont
,1	24.6	28	32	65	8	24.3	29	31.6	66
2	20	23.4	25.5	36	9	20.5	22.8	25.6	34
3	22	25	30.	48	10	13	15	16.4	9
4	23.2	25	28.5	48	11	mean	17.3	19.3	16
5	17	19	20	18	12	21.5	25.5	20	32
6	35.5	37.5	42.7	160	13	19.5	20	19	20
7	25	30.2	32.5	74	14	24.5	29.5	33	72

# The EXPLANATION of the Dimension-Book.

### Of the UTENSILS.

I. In the first Column to the lest Hand, at the Top of the Scheme, are enter'd the Diameters of the Mash-Tun, which stands upon three Areas, the Diameters being taken on every ten Inches from the Bottom upwards, (as are the Copper and Guile-Tun.) In the second Column stand the Areas of those

those Diameters. II. In the third Column are the Diameters of the Copper, and in the fourth are the Areas of those Diameters. III. In the fifth Column are the Length and Breadth of the Back, with the Area under the fame. IV. Following this, in the 6th, 7th, and 8th Columns, are enter'd the Diameters of three round Coolers, (or open Tubs) mark'd 1, 2, 3, all fet upon mean Diameters, with their respective Areas underneath the same. V. Next are enter'd the transverse and conjugate Diameters of an oval. Cooler, with its Area. VI. Next to the oval Cooler are placed the Diamets of two Guile-Tuns, taken in the Middle of every ten Inches, as the Mash Tun and Copper before-mentioned, with the Areas placed overagainst the respective Diameters.

Part II.

The Figures placed over the Utenfils shew the respective Depths thereof. Under the Utenfils there is a blank Scheme, ruled in the same manner as that above: This is ready for inserting the Dimensions of any new Utenfil, when the old one is either demolish'd or laid aside; and when this is to be done, the old Dimensions must be cross'd over with the Pen, and the Dimensions of the new Utenfil be enter'd underneath it, and the Time of its being

gauged must be placed over the new Dimensions.

#### Of the CASKS.

I. Underneath the Utenfils are placed the Dimensions and Contents of the Several Casks, against their respective Numbers in the first Column. The Casks themselves are number'd with White Lead and Oil, from 1 to 14, being the Number of Casks in the Victualler's Cellar. II. The Column titled H. is for the Head, that titled B. is for the Bung, and those titled L. and Cont. are for the Length and Content in Ale Gallons gauged as a Spheroid. (See Part I. Page 129.)

N. B. The Space betwixt each Cask is left so wide, that upon the Alteration of any Cask, the new Dimensions may be enter'd just below; and when this is done, you must strike out the old Dimensions, by drawing

your Pen through the aubole Line.

The above Method must be observed for every Victualler, &c. in your Division, and must be transcribed into your Stock-Book every 1st, 3d, 5th, 7th, and 9th Round.

What follows relates to the Scheme of the Division on Page 54. Part II. which for want of Room there, is here inserted.

N. B. In those Divisions where Houses are to be survey'd cautionarily, as mentioned Page 21. Part II. there is another Column of Miles including the cautionary Houses.

If you have any Starch-Makers, Dealers in Coffee, &c. there must be Columns titled for them in the Scheme; and there is sometimes a Column

added to the right Hand, referring to the Malt, &c. Pages.

The Number of Miles, &c. in each Round must be added up, exclusive

of the Number of Miles, &c. in the Place of your Residence.

When you have any extraordinary Compounders, the Names of the Places where they refide must be enter'd under the Scheme, and also the Names of the Places in the Scheme, between which such Compounders lie, with the Distance from each.

N. B. The following VOUCHER must be wrote upon a large Sheet of Paper, and folded up in long Octavo, and indorfed as under.

Excise Third Round 17--

# Worcester Collection,

# Bromsgrove Second Out-Ride VOUCHER;

From Sept. 26, to Nov. 8 following.

X. 281 VJ. 1374 } 81 6 4

CASH, Eighty one Pounds Six Shillings and Four Pence.

Fines
Surcharges
Arrears
Nil.

Fitz Lambe, Supervisor. Charles Leadbetter, Officer.

**55	u	rorce	ester	-C	follection, Septembe	B	rom,	gros to	ve No	2d Ou vember 8
		X.	VJ.	C.			X	. [V]	.10	<b>}.</b>
September October	3	6 <sup>1</sup> / <sub>4</sub> 6 <sup>1</sup> / <sub>5</sub> <sup>1</sup> / <sub>2</sub>	1,0,110,110		O & obe	1	8 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3	0.
Odds	9 18 25	3 <sup>1</sup> / <sub>4</sub> 3 <sup>1</sup> / <sub>4</sub> 3 <sup>1</sup> / <sub>4</sub>	1 4 1 1 1 2		Oda	ts 3	0 2	1 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	3 4	
Will. Harvey	-	26 <u>1</u>	41/2	-	Matt. Sander Octobe	-	10	$\frac{3}{4}$ $7\frac{1}{2}$ 1	3	
October	2 7 14 19	34 34 34 34 34 32 34	1 4 1 4 1 4 1 4 1 4		Odd	2 2 3	8 1	2 1 2 1 2 1 2 3 4	3	Will.
November Odds	25 1 7	3 <sup>1</sup> / <sub>2</sub> 3 <sup>1</sup> / <sub>2</sub> 1 <sup>1</sup> / <sub>4</sub>	1 4 1 4 1 4 3 4		James Rutter Octobe	7	5 2	3 4 4 3 1 2 3 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1		John C
John Rawlins		26 <del>3</del>	91/2		Odd	ls 2	3	3 1 2 2 2		Oa
September October	29 12	13	1 1 2 1 2		Hen. Leadbur	-	2	-	_	
Odds	24	134 134 34	1 1 2 1 2 1 2 1 2 1 4		O&tober	1		3434		Edward B Tho. San
Will. Ballamy		74	21/4		Odds	3	3 22	1		08
	10	$\begin{bmatrix} \frac{1}{2} \\ \frac{1}{2} \\ 1 \end{bmatrix}$	1 2 1		Benj. Duce	-	74	-	_	
	18 24 31	$\begin{array}{c} I\frac{1}{2} \\ I\frac{1}{2} \\ I\frac{1}{2} \end{array}$	12 12 12 12 12 14	-	O & ober		1   1	1 3		o
Odds		1/2	-			23	3 14	3 4		George Wit
John Lewis October	51	8 2 <sup>1</sup> / <sub>2</sub>	$2\frac{3}{4}$ $1\frac{1}{4}$	-	Odds		34	1 2		Octobe
	18	2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	1 4 1		Tho. Durling October		5 1 3 4 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1		-	
Odds	30	2 1/4 1 3/4 1/2	1 1 1 1 1 1 2 1 2 1 2			13	1 1 3 4 1 3	1 2 1 2		Noven O
Will. Taylor	Ţ	114	634		Odds	31		1 1 4		Jos. Towns
	5	1 3 1 1 1 2 1 3 1 4 1 1 1 2	1 4 1	1	Hen. Ballamy	-	94			Octobe
Odds 3	23	1 1 2 3 4	1 1 1 1 1 1 1 2 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1		Uctober	10	24	14 14 14 34 1		Novem
Robert Haycock	_	74	5		Odds	30	3 4	34 1 2		Esther Han
		$\begin{bmatrix} I \\ I \frac{1}{2} \\ I \frac{1}{2} \end{bmatrix}$	12343	1	Rich. Ballamy	-	92	5		Octobe
2	8	1 ½ 1 ½ 1 ½ 1 ½ 3 ¼	माय क्षेत्र कांक कांक कांक मान		October	13	2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1		Novem O
Mary Forden		$7\frac{3}{4}$	4		Odds	31	2 1 1 2	1 2 3	1	John Fitt
October 1	8 2	$\begin{bmatrix} 2\frac{1}{4} \\ 2 \\ 3 \end{bmatrix}$	1 4 1	-	Ifaac Oakal		14	81		O&tol
Odds 23	-	134 134 12	ज्युवज्ञ[यम]य		October	8 15 21 26	2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	1 3 1 1 1 2 1 3 1 4 1 1	-	Novemb
Fra. Carpenter	18	31	41		Novemb. Odds	2	2 3	1 1 2		Oa

John Farr

78 1 46 3

103 1 383

Sam. Adki

d Out-Ride VOUCHER for Ale and Beer, from

		X.	V.	,C			X.	VJ.	C	1.	s.	d	
O&ober .	13	3	1 1	3	O&ober	13	1212121214	14 14 14 14 14 14		-			
	21	32	1	31	Odds		1/4	4	_	1			8
Odds	31	34	1	2 3	Mary Povey		13	1	_				
	-	-	_	4	October	19	স্কুল্পন্ত প্ৰদ	1212121214					
Will. Hall October	16	112	II	+	November Odds	3		1 2					
Calca	15	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	3	John Andrews		$\frac{4}{2\frac{1}{2}}$	13/4	-				
Odds	29	1 4 2			October	8	1 4 1 4	ন্ম ন্থ ন্থ ন্থ প্ৰ প্ৰ প্ৰ					
John Onion October	1 4	61/4	3		November	22 29 3	I I 1 2 I 1 2	4343					1
	11	3 4	The solution of		Odds		2						
Odds	_	2		-	James Ford	5	7	31/2	_				
lward Bland		23/4	1-2	-	Tho. Phithian September	m.	21/2	21/2	-7				١
bo. Sanford	L	Nil	Nil		October .	30		_	24				١
October	4	14	34110			15		_	14				
	19	14	12		Eliz. Wagstaff		10011	4031	34	28			
Odds	24	1 4 1 2	121212121212		2d Column 3d Column		78 <sup>1</sup> / <sub>2</sub> 85 <sup>1</sup> / <sub>4</sub>	38 <sup>3</sup> / <sub>4</sub> 46 <sup>3</sup> / <sub>4</sub> 43		22	9 14 3	10	
orge Withers		63	34		4th Column	_	1334	83	5 4	5	18	9	
October	6	21/2	$1\frac{1}{2}$ $2\frac{1}{4}$			1/2	81 1	3745	3 8	31	6.	4	
	22 29 31 3	$4\frac{1}{2} \\ 2\frac{1}{2} \\ 2\frac{1}{4} \\ 2\frac{1}{2} \\ 2\frac{1}{2} \\ 2\frac{1}{2} \\ 2\frac{1}{2} $	1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		The Amount of Hundred and Strong, with Seven Barrels Beer, and Fi	On , ar	ighty e Hund od On	-one ndred e Firl	Ba an sin	d of	els This Sm	of ty all	
S. Townsend		173	10		Fourths of C	yde	r.						
October November Odds	4 13 22 3	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	] 34 1 2 1 2 1 2		lings, and Fo	ur P	ence.				•		
her Handly		64	31										
	6 15 22	1 3/4 1 3/4 1 1/2	I 2 I 3										

MAR

November Odds

John Fitter October

November Odds

am. Adkins

851 43

31

134

83 53

Worcester-Collection, Bromsgrove 2d Out Ride. ABSTRACT The Form of and for Ale and Beer, from September 26. to November 8. Ale and Beer Abnext following, 17- Third Round.

Victuallers Names, &c.	X.	VJ.	Cyd.		1.	s.	4
William Harvey -	261	41/2			6	18	
John Rawlins -	263	91/2			17	6	
William Ballamy-	73	21			2	1	1
John Lewis	8	23/4			2	3	1
William Taylor-	1114	63	4,11 %		3	5	
Robert Haycock	74	5			2	2	1
Mary Jorden	7 <sup>3</sup> / <sub>4</sub> 8 <sup>1</sup> / <sub>4</sub>	4			2	4	
Frances Carpenter —	81	4			2	6	1
ift Column —	1031	383			28	9	-
Matt. Sanders	103	74	2500		1 3	4	1
James Rutter ———	$6\frac{3}{4}$	4			1	19	1
Henry Leadbury	23/4	2			0	16	5
Benj. Duce	74	41		4	2	2	3
Tho. Durling-	53	4	10,00			14	1
Henry Ballamy	94	23/4			2	9	11
Richard Ballamy	91/2	5			2	14	2
Ijaac Oakal	. 14	81/2	2		4	+	C
John Farr -	121		30 00		3	13	IC
2d Column —	781	463 1	1		122	14	10
William Hall -	213	11			6	3	5
John Onion -	$6\frac{1}{4}$	31/2	125		1	15	11
Edward Blun -	23/4	13	200		0	16	4
Tho. Sanford———		Nil					
Geo. Withers -	63	34			I	18	1
Fos. Townsend -	173	101			5	2	9
Esther Handly -	61	34	1		1	15	7
John Fitter -	83	51/2			2	11	1
Sam. Adkins-	15	44			4	0	8
d Column —	854	43			24	3	_7
Mary Povey	13	1 1	1		0	10	1
John Andrews-	21/2	13			0	14	10
James Ford -	7	3-2			1	19	8
Tho. Phithian-	21/2	21/2			0	15	10
Eliz. Wagftaff-			5 3/4		1	18	4
th Column	134	83	5 <sup>3</sup> / <sub>4</sub>		5	18	9
ft Column	1031	3831	0 4		28	. 9	2
d Column ———	781	463			22	14	10
d Column	854	43			24	3	7
th Column-	133	$8\frac{3}{4}$	5 3		5	18	9
		1374	53		81	6	4

Charles Leadbetter, Officer.

N.B. The foregoing ABSTRACT \* must be wrote upon a large Sheet of Paper, and folded up in Long Ostavo, and indoried as under.

How Ale and Beer Abstract must be indersed.

EXCISE 3d Round, 17--

Worcester-Collection,

Bromsgrove 2d. O. R.

### ABSTRACT

From Sept. 26. to Nov. 8. following.

X 281 VI 1374 81 6 4

> Fitz Lambe, Supervifor. Charles Leadhetter, Officer.

> > Worcester

All Abstracts remain in the Custody of the Collector, but the Voucbers go up to the Board,

N. B. The following VOUCHER must be wrote upon a large Sheet of Paper, and folded up in long Octavo, and indorfed as under.

MALT Third Round 17 --

# Worcester Collection,

# Bromsgrove Second Out-Ride VOUCHER;

From Sept. 26, to Nov. 8 following.

Beft. Floor.  $\begin{array}{ccc} S_{492} & Floor. \\ S_{492} & Nil \\ S_{34} & S_{44} \end{array}$  110 19  $\begin{array}{ccc} S_{34} & S_{44} \\ S_{34} & S_{44} \end{array}$ 

Cash, One Hundred and Ten Pounds, Nineteen Shillings and Nine Pence Three Farthings.

Fines
Surcharges
Arrears
Nil.

II.

n a

Fitz Lambe, Supervifor. Charles Leadbetter, Officer.

	Cift. and Couch.	Floor Cyder.		Couch.	Floor	Cyder		Ciff. and	Floor.	Cyder.
September 27 30 October 5 10 15 21 27 October 5	62 64 63 65 65 65		September 29 4 9 12 17 21 25 - 30 4 Odds	54 58 53 56 59 54 60 3			September 30 October 3 7 12 17 21 25 November 4 Odds	56 61 53 54 51 60 60 55 53		
Novemeber 2  Odds —	65 53 63 55 56 40 2		September 30 October 5 10 13 19 24 29	42 44 42 43 43 47 41 2			John Harrison  September 29 3 7 12 16	5°7 1 55 60 55 54		
Thomas Sheward September 26	901 65 62		Henry Parsonage	820			20 25 29	50 57 56		3
30 5 9 14 19 25 Odds — 29 O&ober 5	62 62 58 64 51 2 42		September 30 October 4 9 14 18 21 24 26	50 51 50 54 55 49 51 52 52			November 1 6 Odds — September 26 October 1 4 9 13	53 60 4 58 63 58 58 53 56		
10 15 21 26 31 November 4 Odds—	42 41 30 39 32 41 2		November 1 4 7 Odds — September 26 October 1	42 51 51 6 52 43 31			22 27 1 5 Odds –	54 55 53 50 4		
Jos. Smith	734	-	13	53 55 37			Richard Bailes, Oct.15	53		**
Fran.Knight, Sept. 14 Sepsember 30 October 5	53	1 3/4 2 1/4 1 3/4	23 28 31 November 3	37 41 27 31 19 50			Ostober 7 12 18 Odds —	45 56 44 2		
Eliz. Wag flaff			Odds —	5			Tho. Hunt	147		
			Henry Sheward	1058			October 10 15 21 Odds —	51 51 49		
57 2d	Column Column Column		$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	la se			Tho. Hanson  Geo. Wilmot Jos. Stephens	Nil Nil	Nil Nil	
MAR			5492 5 3 110 19 3	_			Rt Ho. the Earl of Plymouth comp.  Benj Jollife, Esq; comp. Heads		IVIII	

N. B. The Amount of the three Columns of this Malt Voucher are placed (for want of Room) in the Middle, which ought to have been placed at the End of the last Column, as is done in the Ale and Beer Voucher.

The Amount of this Voucher is Five Thousand four Hundred ninety-two Buscless from Best; with five Hogsheads and three Fourths of Cyder.

Cash, One Hundred and ten Pounds, nineteen Shillings and nine Pence three Farthings.

Charles Leadbetter, Officer.

1688 |

1878

Worcester Collection, Bromsgrove 2d Out Ride, The Form of a Abstract for Malt, from September 26 to November 8, next following, 17 -- Third Round.

Malster's Names, &c.	Ciftern and Couch.	Floor	Cyder.	I.	5.	d.
Tho. Sheward Jos. Smith Francis Knight Eliz. Wagstaff	901 734 53	1	5 <del>3</del>	18 14 1	13 1 3	4 <sup>3</sup> / <sub>4</sub> 7 <sup>1</sup> / <sub>4</sub> 2 <sup>1</sup> / <sub>2</sub> 0
ift Column	1688		5 3 4	34	18	21/2
Henry Parsonage  Henry Sheward	820		3 8	16	8 3	0 2 1 2
2d Column	1878		\	37	11	21/2
John Harrison ————————————————————————————————————	507 1067 53 147 152			10 21 1 2 3	2 6 1 18 0	9 <sup>1</sup> / <sub>2</sub> 9 <sup>1</sup> / <sub>2</sub> 2 <sup>1</sup> / <sub>2</sub> 9 <sup>1</sup> / <sub>2</sub> 9 <sup>1</sup> / <sub>2</sub>
3d Column —	1926			38	10	41/2
ıft Column ————————————————————————————————————	1688 1878 1926		534	34 37 38	18	2 1/2 2 1/2 4 3/4
Total	5492		5 3 4	110	19	93

Charles Leadbetter, Officer.

<sup>\*</sup> The Duty of Cyder is 10 s. 8 d. per Hogshead; 6 s. 8 d. of which is charg'd in the Excise, and 4 s. in the Malt Voucher.

N.B. The foregoing ABSTRACT must be wrote upon a large Sheet of Paper, and folded up in long Octavo, and indorsed as under.

How a Malt Abfract must be in-

MALT 3d Round, 17--

Worcester-Collection,

Bromsgrove 2d O. R:

# ABSTRACT

From Sept. 26. to Nov. 8. following,

Beft Floor 1. s. d. 5492 Nil 110 19 93

Fitz Lambe, Supervifor. Charles Leadhetter, Officer.

### CHAP. XIII.

Instructions for obtaining the Allowance of the Drawbacks, or Bounties on the Exportation of several Exciseable British-made Goods to Foreign Parts, viz. I. Beer, Ale, Mum, Cyder and Perry. II. Malt of Barley and Wheat. III. Leather Tanned, Taw'd, or Dress'd in Oyl, &c. Boots, Shoes, Gloves, &c. IV. Sope. V. Candles. VI. Starch. VII. Papers, Paftboard, &c. VIII. Silks, Callicoes, Linens, &c. IX. Spirits drawn from Barley, Malt, or other Corn.

I. The Drawback of the Excise on Strong Beer, of the Drawback Strong Ale, Mum, Cyder, and Perry made in on Beer, Ale, Mum, Cyder, and Great Britain \*.



NY of the aforesaid Liquors may be shipp'd off to be Exported into Foreign Parts, as Merchandice from the common Keys of any lawful Port within the usual Hours of Excise, in the Presence of a sworn Gauger, or other sworn Officer of Ex-

cise, upon Notice given at the Excise-Office within the Limits whereof the faid Liquors were brew'd or made; and upon the faid Gaugers or Officers certifying the Quantity of fuch Liquors Ship'd off, to the Officers of Excise where the Entry was made, they are to repay the Excise of the faid Liquors so exported, to the Brewer, or Maker thereof, within one Month after Exportation, deducting 3 d. per Ton Charges, &c. but no Drawback to be allow'd for what is taken aboard for the Ship's Use.

The aforesaid Liquors unladen, or laid on Land, or put into any other Ship, or Veffel, within Great-Britain, are forfeited,

and 50 l. for every Cafk.

II. The

<sup>\*</sup> The Acts of Parliament relating to the Drawback, &c. on these Liquors, which, for more particular Satisfaction, may be confulted, are, I W. & M. Chap. 22. Sect. 1, 2. 5 Ann. Chap. 8. Art. 7. 4 Geo. I. Chap. 3. Sect. 8, 10. 7 Geo. I. Chap. 20. Sect. 21.

Of the Bounty on Malt exported.

The Bounty on MALT Exported.

Price per Quarter,	Bounty per Qu	uarter,
Winchester Mea-	Winchester	Mea-
fure.	fure	

Malt made of Barley 0 2 6 Malt made of Wheat 0 5 But the Excise of 6 d. per Bushel must not be reckon'd into

The Excise of 6 d. per Bushel not to the Price of the Malt. e included.

When the above Sorts of Malt ground or unground, do not at the Port of Exportation exceed the respective Prices abovemention'd, and shall be shipt aboard a British Ship, whereof the Master, and at least two thirds of the Mariners are British Subjects, in Order to be Exported to Parts beyond the Seas, the Exporter is to be allow'd the Bounties above-mentioned, provided a Certificate in Writing under the Hand of the Exporter, containing the Quantity and Quality of the Malt be first brought to the Collector of the Port, and the Truth thereof confirm'd by the Oath of one or more credible Person, or Per-ABond tobegiven, fons, and a Bond be given by the Exporter of 200 l. for every

100 Ton, (i.e. 8s. per Quarter) that the same shall be exported into Parts beyond the Seas, and not be re-landed in Great-

Britain, or the Hlands of Guernsey or Jersey.

After what Rate to be allow'd.

But then this Bounty upon Malt is only to be allow'd after the Rate of 30 Quarters, and no more, for every 20 Quarters of Barley, or other Corn or Grain enter'd and made into Malt for Exportation, as shall appear by a Certificate from the Officer, with whom the Corn or Grain, intended to be made into Malt for Exportation, was enter'd. The aforesaid Bounty to be paid by the Collector of the Port upon Demand made by the Exporter, unless he has not sufficient Money in his Hands, and then he is to certify the same to the Commissioners of the Customs, who are to cause the Money to be paid by the Receiver-General within three Months.

The aforesaid Bond given for the Exportation may be de-When the Bond is to be deliver'd up. liver'd up to be cancell'd, upon producing a Certificate under the common Seal of the Chief Magistrate, in any Place beyond the Seas, or under the Hand and Seal of two known British Merchants, testifying, that the Corn was there landed; or upon Proof by credible Persons that 'twas taken by Enemies, or perish'd in the Seas.

Malt re-landed in Great-Britain, is forfeited with treble Malt re-landed the Value, besides the Penalty of the Bond, and since contiforfeited, and

treble the Penalty nued Yearly with the Malt Act. of the Bond.

III. The

The Acts relating to the Drawback on Malt and Barley Exported are, I W. & M. Chap. 12. Sett. 2.72 & 13 W. III. Chap. 10. Sett. 91. 5 Ann. Chap. 29. Sett. 10. 3 Geo. II. Chap. 7. Sell. 15.

III. The Drawback on Hides and Calves Skins, Of the Drawback Tann'd, Taw'd, or Dress'd, in Great-Britain\*, Calves Skins. for every Pound Averdupoize Weight is two thirds of the Duties that have been paid for the same.

All Hides or Calve Skins, dreft or curried, are also to draw Of Hides and back One Penny per Pound Weight, as they shall weigh at the Calves Skins dreft Custom-bouse.

Or curried.

Note. All Sheep-skins and Lamb skins, which are tann'd, Of Sheep-skins taw'd, or drest, are to drawback two thirds of the Duty.

N.B. On Page 29. Part II. is a Table, shewing the Duties payable for the several Sorts of Leather.

The Hides and Calve-skins having paid Duties at the Time Hides and Calves-of Tanning, and having been mark'd with a Stamp to denote skins tanned, havthe same, the aforesaid two third Parts of those Duties may, ing paid Duty.

upon Exportation to Foreign Parts be repaid by the Collector
of the Duty at that Port, provided sufficient Security be first
given to the Collector of the Customs that they shall not be relanded in Great-Britain; whereupon the said Collector is to
grant a Debenture, expressing the Kinds, Quantities, and
Weights exported; and this Drawback may be allow'd, altho' the Marks have not been seen by the Officers of the Customs, provided, that Oath be made before the Collector of
the Customs, that the Hides or Skins contained in the respective Bales or Packs were mark'd with the Stamps, denoting
the Payment of the Duties, and how much the Duties amounted
to, together with the Weight exported; but if any of the said
Skins or Hides are re-landed, they are forseited, and treble the
Value.

The Drawback on Boots, Shoes, Gloves, and other Manufactures made of Leather tanned, tawed, or drefs'd in Great-Britain, is for every Pound Averdupoize Weight, One Penny Half-penny.

How the feveral Sorts of Hides and Skins are to be mark'd Concerning the or flamp'd, is shewn on Page 25. Part II. and so is on Page marking Hides 28, the several Denominations of Tann'd Hides, which are and Skins, &c. comprehended under the Names of Soal Leather and Upper Leather.

### IV. The

The Acts of Parliament, which relate to the Drawback on Leather of all Sorts, and Manufactures made of Leather exported, are, 9 Ann. Chap. 11. Sect. 39, 40. 10 Ann. Chap. 26. Sec. 6. 12 Ann. Chap. 9. Sect. 68, 69. 2 Geo. I. Chap. 7.

of the Drawback IV. The Drawback on British-made Soap \*, for en Scap. every Pound Averdupoise Weight is One Penny Half-penny.

> Which Duty (having been paid by the Maker) may be repaid by the Collector, upon Exportation, provided, Security be given to the Collector of the Port hefore Shipping, that they shall not be relanded in Great-Britain, and Oath be made before the Collector of Excise, that the Duty has been paid; and a Debenture granted by the Collector of the Customs, expressing the Kinds and Quantities and the Shipping, testified by the Searcher. But if relanded, forfeited, or the Value, befides the Penalty of the Bond.

of the Drawback V. The Drawback on British-made CANDLES +. on Wax and Tal-Wax Candles the Pound Averdupoise Weight low Candles. is Eight Pence: All other Candles the Pound Averdupoise Weight is One Penny.

> Which Duties (having been paid by the Maker) may be repaid by the Collector, upon Exportation, provided Security be given to the Collector of the Customs before Shipping, that they shall not be relanded in Great-Britain, and Oath be made before the Excise Collector, that the Duties have been paid, and his Certificate thereof, with the Kinds and Quantities; and likewise Oath before the Collector of the Port, that they are the same mentioned in such Certificate: Whereupon the Collector of the Customs is to grant a Debenture, expressing the true Quantity exported; but if re-landed, forfeited, or the Value, besides the Penalty of the Bond.

Of the Drawback VI. The Drawback on British-made STARCH !. on Starch. for every Pound Averdupoise Weight is Two Pence.

> Which Duty (having been paid by the Maker) may be repaid by the Collector, upon Exportation to Foreign Parts by way of Merchandice, provided sufficient Security be given to the Collector of the Port before Shipping, that it shall not

The Acts relating to the Exportation of British-made Scap, are, 10 Ann. Chap. 19. 12

Ann. Sess. 2. Chap. 9. 3 Geo. I. Chap. 7. 6 Geo. I. Chap. 4.

† The Acts relating to the Exportation of British-made Candles, are, 8 Ann. Chap. 9. 9

Ann. Chap. 6 & 21. 3 Geo. I. Chap. 7.

| The Acts relating to the Exportation of British-made Starch, are, 10 Ann. Chap. 26. 12 Ann. Seff. 2. Chap. 9. 3 Geo. I. Chap. 7. 6 Geo. I, Chap. 4.

be re-landed in Great-Britain, and Proof be made upon Oath before the Collector of the Customs, that the Duties have been paid: Whereupon the said Collector is to grant a Debenture, expressing the Kinds and Quantities, with the Shipping, testified by the Searcher; but if relanded, forfeited, or the Value, besides the Penalty of the Bond.

VII. The Drawback to be allowed on British of the Drawback made Papers, Millboard, Pasteboard, and Scaleboard; as also on Printed, Painted, or Stained Paper for Hangings \*, are the respective Duties thereon, which you will find set down Part II. Page 45.

Which Duties are to be repaid on Exportation under the same Regulations as British made Soap; for which see Page 62.

VIII. The Drawback on Silks, Callicoes, Linens, Of the Drawback and Stuffs, printed, painted, stained, and dy'd coes, Sc. in Great-Britain, is specify'd by Acts 10 and 12 of Anne +.

N.B. Callicoes, Linens, and Fustians dyed throughout of one Colour; and Stuffs made of Woollen, or whereof the greatest Part in Value shall be Woollen, are excepted out of the said Acts. The Exporter before Shipping to give Notice to the proper Officer appointed by the Commissioners of the Customs, when and where he intends to pack up the Goods, who is to take care that the Stamps be taken off from each Piece, and to return an Account of the Kinds and Quantities to the Officer appointed to receive the same, which Duties are to be repaid upon Exportation under the same Regulation as British-made Paper above.

IX. Concerning the Allowance of the Drawbacks of the Drawbacks or Bounties on the Exportation of feveral Ex- on Excifcable British Goods. cifcable British Goods to Foreign Parts ...

Bounty on Spirits exported, drawn from Barley or other Corn, payable at the Custom-House.

The Acts relating to the Exportation of British-made Paper, &c. are 10 Ann. Chap. 19. 12 Ann. Sess. 2. Chap. 9. 3 Geo. I. Chap. 7. 6 Geo. I. Chap. 4. † The Acts relating to the Exportation of Silks, Callicoes, &c. are the same that relate to the Exportation of British-made Paper next above.

the Exportation of British-made Paper next above.

|| The Act relating to the Exportation of the several Exciseable British Goods, is 6 Geo. II.

Chap. 17. Sec. 10.

# Of Drawbacks and Bountles. Part II.

For every Ton of Spirits drawn from Barley, Malt, or other Corn, there shall be paid to the Exporter by the Commissioners of the Customs, or the proper Officers belonging to them, when Barley is at 24s. per Quarter, or under; on such Proof of the Exportation thereof, as is directed by the Act 1 Will. and Mary, for encouraging the Exportation of Corn, out of the Duties liable to the Payment of the Bounties on Corn exported, One Pound Ten Shillings, and so in Proportion for a greater or leffer Quantity.

Of the Drawback The Drawback of the Excise on Spirits drawn on Spirite. from Corn in Great-Britain, without any Mixture of other Materials \*.

> Upon Oath before two or more Commissioners of Excise, or Justices of the Peace, of the Place from whence such Spirits are intended to be exported, that the same are drawn from Corn in Great-Britain, without any Mixture with any other Materials; and that the Duties are duly enter'd and paid, and that the same are exported for Merchandice to be spent beyond the Seas; and upon producing a Certificate under the Hands of the Officers of Excise, for the Port or Place where such Spirits were shipped, of the Quantity so shipped, and that it was in Presence of such Officer; the Exporter is to be allowed or paid back by the Commissioners of Excise, or their Collector of the Port of Exportation, Four Pounds Eighteen Shillings per Tun, and so in Proportion for a greater or leffer Quantity; in full of all Drawbacks and Bounties that can be made for the same, except the Bounty of One Pounds Ten Shillings per Tun, payable at the Custom bouse.

### CHAP. XIV.

Of gauging at the Water-fide.

Of CASK-GAUGING,

As practifed at the Water-fide in the Port of London.

See also Part I. Chap. XXIII. and Plate 4. Fig. 3, 4, 5.



HIS Part of the Art of Gauging is comprehended under the Mensuration of Solids; because the Contents of all Sorts of Vessels used for Liquors, are computed as the they were really felid Bodies, as by the following Dimensions of

the respective Gallons will appear.

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It is the same Act that is next before-mentioned.

# Chap.XIV. Sauging at Water-side.

The Standard Ale Quart, now kept in the Exchequer, made in Pursuance of the 12th of Henry the VIIth, Cap. 5. contains two Pounds of Wheat Troy-Weight, which having, by Experiment, been found to contain 70 1 Cubical Inches; therefore the Ale and Beer Gallon, which, by 12. Car. II. Cap. 23. S. 8. is declared to contain four of those Standard Quarts, must contain 282 Cubical Inches. See Part I. Page 163. also Chap. XVII. Part II. about the Bushel.

And it is enacted and declared by 5 Ann. Cap. 27. S. 17. that any round Veffel, commonly called a Cylinder, having an even Bottom, and being 7 Inches Diameter throughout, and 6 Inches deep from the Top of the Inside to the Bottom, or any Vessel containing 231 Cubical Inches, and no more,

shall be deem'd and taken to be a lawful Wine Gallon.

of The Tun, Pipe, 126 Juch Gallons shall Sa Tun Wine and Hogshead, And that } a Pipe or Butt be deemed an Hogsbead

So that, As { the Ale or Beer Gall. is to cont. 282 } Cubical, or Ale and Wine the Wine Gallon is to contain 231 } Solid Inches. Gallon.

Therefore, as often as either of these Cubes are contained in any other Number of Cubical Inches, so many Ale and Beer, or Wine, Gallons, are contained therein; so that if a Cask was to be reduced to a Rectangular Figure, and the Content in Inches divided by the said Cubes, the Quotient would exhibit the Quantity of Gallons it contains.

But as Casks are made round instead of being reduced to a Casks easily redu-Rectangular Figure, they may more easily be reduced to a ced to a Cylinder

Cylinder, under which Form the respective Gallons contain, viz.

The Ale Gallon 359 \ Cylindric or Circular Inches. The Wine Gallon 294 Part I. Page 47.

Having thus defin'd the Ale and Wine Gallons, I shall now proceed to thew how the Contents of any Cask may be found Contents of Casks in either of those Gallons: Now, in order to perform this, how found, you must first, by the Assistance of proper Instruments, take the respective Dimensions of the Casks, viz.

The Diameter at the Bung within the Cask, In Inches and The Diameter at either Head, supposing the Decimal Parts two to be equal of an Inch. The Length of the Cask within

And in taking the Dimensions of the Cask, you must ob- Concerning the ferve what is faid in Chap. XXIII. Part I. that the Bung Bung and Head Hole be in the middle of the Cask, and that as far as possible of Casks. the Staves be regular and even within, and that the Heads of the Cask be equal and truly Circular, and that in taking the Length of the Casks with a Pair of Sliding Callipers, you observe, that they are so contrived, as to make an Al-

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the Head.

Of Thickness of lowance of 2 Inches for the Thickness of the two Heads, which is equal to the ufual Thickness of the Heads of Pipes, Butts, and other large Casks; but as the two Heads of an Hogshead are usually not more than 1 1 Inch thick; therefore 1 an Inch must be added to the Length found by the Callipers, and fo for the Proportion of what the two Heads of any other Cask may want of the 2 Inches allowed by the Calkpers; and if, upon boring the Heads of any Cask, they are found to exceed the two Inches allowed by the Callipers; then the Excess must be deducted from the Length found, and the Remainder will be the true Length within the Cask after the Dimensions are taken: you must next consider the Form or Shape of the Cask Shape of the Cask, as under which of the Varieties it may be comprehended; for, altho' the Dimensions of several Casks may be equal, yet according to the Curvature of the Staves they will contain more or less Liquor; therefore it is plain,

to be confidered, and why.

### See Plate I. Fig. 18.

that no one certain or general Rule can be prescribed to find

the true Content of all Sorts of Casks.

A and B represent two Rods to flide by each other, and which are divided into Inches, and these into Decimals or Tenths. C and D represent those Parts of the Callipers, which are to touch both Ends of the Cask you want the Length of; when the Callipers are fo fix'd, that C and D touch the Heads of the Cask, the Length of it is shewn by the Figures upon the Rod A and B.

With the Callipers, there's usually two other Rods made use of, called the Head, and the Bung Rods, for finding the Diameter at the Ends, and Bung of the Cask; and these three Instruments are accurately made by Mr. Nathanael Smith, Mathematical Instrument-maker, in Preston-Yard in the Mi-

nories near Tower-Hill, London.

As to the feveral Forms or Shapes of common Casks, such as Pipes, Butts, Hogineads, Awms, Barrels, &c. it is agreed, that they may all be pretty nearly comprehended under fome

One of the Solids.

Note. No Cask will contain more than the middle Frustum of a Spheroid, or less than the middle Frustum of two Cones; fo that all the Varieties will be between those two; and if, by observing the Form of a Cask, it be thought not to be strictly of any of the five Varieties, such Allowance must be made by Discretion, as will reduce it to the nearest of the faid Forms; the properest Method of making which Allowance being either by adding to or subtracting from the real Length.

Tho' in the Theory of Gauging it is proper, for Demonstration Sake, to treat of the feveral Forms under which all Casks may be comprehended, and to shew how their Contents may entered in the O .: be found; yet in the Practice of the Customs, and Excise at

A Note.

Cafks how to be

ficer's Books.

# Chap.XIV. Sauging at Water-fide.

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the Water-fide in the Port of London, as most Casks may be justly comprehended under the first Variety; and when they are of any other Form, it would be necessary to specify it in the Land-waiters and Excise Officers Books, for the Information of those, who are afterward to examine and checque the Accompts; therefore the Contents of all Casks are inserted in the said Officers Books, as if they were really of the first Variety; and in Consideration of their being of any other of the aforesaid five Varieties, or a Medium between any of them, they make such Allowance in the Length, either by adding or subtracting, as from the Judgment of their Observations will reduce them to that Form; but this requires much Practice and nice Observation, more than I fear can be met with among the Officers of any other Port.

Since I am treating of Cask-Gauging, &c. as practis'd at the Custom-House; the following Remarks about Imported Goods may possibly be of some Use to those Officers who survey Sea-Port Towns.

ANCHOVIES, the little Barrel to contain 16 Pounds Anchovies, of Fish.

APPLES, the Barrel to contain 3 Bushels.

Apples.
Argol.

ARGOL, in Casks, the Tare is 14 lb. per Cent. POT-ASHES, the Tare is 10 lb. per Cent.

Pot Afhes.

PEARL-ASHES, of and from Germany, the same as Pot-Pearl Ashes.

WEED ASHES the LAST, to contain 12 Barrels of Weed Ashes. 200 lb. each.

BASKET-RODS, the Bundle is to be 3 Feet about at the Basket Rods.

SPRUCE-BEER is always imported in Kegs, or half Spruce Beer.

• Kegs, the Keg containing, when full, 4 Gallon, and the half Kegs 2 Gallons.

So that  $10\frac{1}{2}$  whole, or 21 half Kegs, when full, are Kegs and half efteem'd a Barrel for the Customs; and 8 whole, or 16 half Kegs. Kegs, when full, are esteem'd a Barrel for the Excise. But as the said Kegs and half Kegs are never imported quite full, therefore some are usually emptied to fill up the rest; and sometimes (tho' but seldom) they are not filled up, and then about 1 in 10 is allow'd, in Consideration of what they want of being full.

N.B. The Barrel to contain { for the Customs 42 } Wine Gall.

HIDES in the Hair, and not chargeable with the Hides, new Duties, are only to be tallied at the Delivery; but the following Sorts being tann'd, taw'd, or dreffed, are to be flampt with a proper Hammer to denote the Payment of the new Duties granted by 9 Anne, chap. 11. and 10 Anne, chap. 26. See Part II. page 25.

E 2

Buffalo,

Barrels.

Buffalo. Buffalo, Elk. Elk, and all other Hides dress'd in Oil or Tann'd. Loshee, Loshee. Ruffia. Ruffia, Cow, Cow. Horfe. Horfe, and all other Hides dress'd in Alum and Salt, Gelding. Gelding, or Meal, or otherwise Taw'd. Mare, Mare. Steer, Steer. Honey. HONEY, 12 Pounds make a Gallon. 42 Gallons make a Barrel. Hops.

HOPS in Bags, Tare 4 lb. per Cent. Mum.

MUM the Barrel for the Customs 42 to contain, for the Excise 32 Mum is imported in Casks of a certain Size, viz.

Barrels, containing when full Half Barrels, Half Barrels, containing when full 24

According to which Contents they are always passed, it being impracticable to gauge them by reason of the Froth, and the Bung's not being in the middle; tho' if a new Bung was to be bored, and the Dimensions exactly taken, and the Contents computed as for other Casks (a Spheroid) they would be found to be near what follows, viz.

Full Content. Head. Bung. Length. 48 Wine Gallons. 18.5 32.2 22

But as the faid Barrels and Half Barrels are never imported quite full, therefore some are usually emptied to fill up the rest; and if there is any Part of a Cask remaining, which is not used in filling up, the Ullage Content is found by taking the full Content of it by the Diagonal Rule, (in Plate 1. Fig. 13.) and the Bung and Wet Inches as usual, by which find its Ullage, as has been taught in Page 139, &c. Part I.

CHESS-NUTS, Small Nuts, and Wall Nuts, are rated by the Barrel, which is 3 Bushels, and are generally imported loose; but after having been measured on board by a City Meter, are put into Baggs, containing (generally) one Barrel each, in

Order to be brought on Shore.

OLIVES. If imported in large Casks must be gauged, but if in small Casks or Jarrs, the Contents may be computed; and according to the present Practice in the Port of London, have an Allowance of  $\frac{1}{3}$  Part in Confideration of the Liquor.

OILS in certain Casks, 1 in 20 allowed for Leekage; under 10 none.

In Candy Barrels, Tare 29 Pounds per Barrel, In uncertain Casks, Tare 18 Pounds per Cent.

7½ Pounds make a Gallon. 252 Gallons make a Ton.

Tho' Oils of all Sorts pay Duty by Measure, yet it is not Oils 7 Pound and a half to a Gallen, the Practice to gauge them; but if imported in uncertain Calks,

Nuts.

Olives.

Oils.

# Chap. XIV. Sauging at Water lide.

Casks, they are weighed, and the Gross Weights (after the Deduction of Draught and Tare) are reduced to Measure by accounting 7 1/2 Pounds to the Gallon: For the Operations whereof take the following Rules.

RULE the First.

The first Rule.

Multiply the Gross Hundreds Weight (after Deduction of Draught) by the Net Pounds in One Hundred Weight, after the Deduction of the Tare, that is by 94; and the Product will be the total Net Pounds; or the Tare may be deducted from the Gross Weight, and the Remainder be reduced to Pounds.

Which may be multiplied by 2, to bring them into Half Pounds, and divided by 15 the half Pounds in a Gallon: Or the Net Pounds may be divided by 7.5, Or the Net Pounds and their 1/3 Part may be added together, and the last Figure towards the Right Hand of the Total cut off. Methods will reduce them to Gallons; and those Gallons be-

ing divided by 252, will produce Tons.

Example. Suppose 36 C. Gross after Deduction of Draught. An Exampler-Common Multiplier 94 Net Pounds per Hundred Weight,

> 144 324 13)3384 Net Pounds.
> add 1128 252)451.2 Gallons (1.79 Tons, 252 1992 1764 2280 2268 12 Or thus,

Or thus, 3384

7:5)3384.00(451.2 Gallons.

15)67680(451.2 Gallons.

RULE the Second.

Divide the Gross Hundred Weight (after Deduction of The second Rules Draught) by 20, and the Quotient will be Tons, esteeming each 5 Hundred Weight in the Remainder, as 63 Gallons,

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and each fingle Hundred Weight, as  $12\frac{1}{2}$  Gallons, which being added together, from the total Deduct  $1\frac{1}{3}$  Gallons for each Ton, and the Remainder will be the Net Quantity.

An Example.

Example. Suppose 36 C. Gross Weight as before, how many Gallons doth it contain?

Operation.

20)36(1 Ton.

5)16(3 multiply'd by 63. gives 189 Gallons.

And  $\frac{1}{3}$  of 63 = 12.5 Zon. 5 Gallons.

Answer 1 201.5

Train Oil

TRAIN-OIL of the British Plantations. In uncertain Casks is allowed 18 Pounds per Cent. but in certain Casks, as Barrels, it is the Practice in the Port of London to allow 50

Oils in Jars, &c.

Pounds per Barrel for Tare.
OILS in Jars and Chefts: The whole Jars are usually passed at 24, and sometime at 22 and 26 Gallons each, the whole Chefts are usually passed at 8 Gallons each; and the half Jars and half Cheft, at half the Quantity of the whole.

Rum.

RUM, Casks of, generally contain these Dimensions, viz.

H.	<b>B</b> .	L.	Cont. Wine Gall
26.8	32.I	34.3	108
27.2	32.	36.8	116
26.7	32.4	33.6	107
27.4	32.6	33.	108
28.	32.4	34.6	113
26.8	31.7	32.7	101

Wines.

WINES, The Ton to contain 252
The Pipe or Butt 126
The Hogshead 63
The Awm 42

Imported in Casks, if enter'd filled, are to be delivered by the Gauge of the Wine contained in the Cask; but if enter'd unfill'd, according to the full Gauge of the Cask, tho' there may have been very considerable Leakage.

Ours, what Calks fo effeemed.

Every Hossbead of Wine, which shall be run out, and not full 7 Inches, or above, left therein; and every Butt or Pipe, not above 9 Inches, shall be accounted for Outs, and the Merchant to pay no Duty for the same. But such Outs must not be removed from the Keys, 'till seen and allow'd by the Land Surveyors.

In Flasks and Bottles. Imported in Flasks, or Bottles, Florence Wines, the whole Cheft usually contains 40 Flasks, or 60 Betties, and then are passed at 8 Gallons, tho' Part be broken or empty; and the half Chest, containing 20 Flasks, or 30 Betties, at 4 Gallons:

# Chap. XV. Of Ship Gauging.

But if they contain more or less Flasks, they must be reduced to that Proportion, being 5 Flasks, or  $7\frac{1}{2}$  Betties per Gallon.

French, or other Wines, in Flasks or Bottles, are usually French Wine. passed at 5 Flasks, or Bottles, to the Gallon; but if upon Measuring one or more, they are found to contain more or less, they must be passed according to their real Contents.

If at landing any Wines, the Merchant shall refuse to pay Of Refuse Wines, or secure the Duties, but is willing to deliver them up to the Crown to be publickly sold, in order to be distilled into Brandy, or made into Vinegar; the Ullage Contents of such Casks as are refused, must be taken at the Time of Landing and Delivering up.

And when the faid Wines have been publickly fold, a Certificate, fetting forth the whole Proceeding, is to be made out,

and figned by the Officers concern'd.

CASTILE in double Serns, about 300 Weight, Tare 30 lb. Castile Soap. in fingle Serns, about 300 Weight, Tare 16 lb. in Chests, about 2½ or 300 Weight, Tare 40 lb.

### CHAP. XV.

To gauge a Ship, that is, to find her Burthen or Tunnage.



II.

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O perform this, Ship-wrights observe these three Rules.

- 1. That the Dimensions are taken in Feet, and First Rule. that if you measure the Ship within, you shall find her Content, or Burthen, she will hold or take in.
- 2. If you take the Dimensions on the Outside, to her light Second Rule. Mark as she swims being unladen, you shall have the Content of the empty Ship.
- 3. But if you measure from her light Mark, to her full Third Rule. Draught of Water being laden, you shall have the true Burthen of the Ship: And then, the Length, Breadth, and Depth, multiplied one into another, and divided by 100 for Men of War (because 100 folid Feet are one Tun) which gives an Allowance for Guns, Mass, Sails, Cables, Anchors, &c. which are all a Burthen; but no Tunnage, the Quotient is her Tunnage. And the Square Root of 100 is = 10 the Gauge Point on the Sliding Rule.

E 4

4. But

Fourth Rule.

4. But for Merchant Men, the Length, Breadth, and Depth in Feet multiplied one into another, and divided by 95, gives her Burthen. And the Square Root of 95 = 9.74 is the Gauge Point on the Sliding Rule.

Proportion of Ships.

The true Proportions of all SHIPS are these.

Breadth of the Midship Beam 50 Burth

Depth in the Hold \_\_\_\_\_\_\_ 300 E Man of W

Merchant Burthen as a Man of War 4500 473680

The Cuftom at London.

But at London the Shipwrights have a Custom of Gauging, or Measuring thus: they multiply the Length of the Keel, into the Breadth of the Ship at the broadest Place taken from Outfide to Outfide, and the Product of that by half the Breadth, this Product divided by 94 for Merchant Men, and by 100 for Men of War, the Quotients are the Tuns, the Ship will carry.

Above Rules li-

But none of the above Rules are perfectly true, because two able to Objections. Ships by this Rule, of equal Breadth and Length, shall be of equal Burthen, notwithstanding the Fullness or Sharpness of those Vessels, which may differ their Burthens very much. But the truest Way of gauging of a Ship is best done by mea-furing her as a Piece of Timber of the same Form, and so measure her by Pieces, which Sum of the Particulars in folid Feet added together, and divided as before, gives the Ships Burthen in Tuns.

The truest Methods.

> For Practice, I shall add an Example by Pen and Sliding Rule as follows.

An Example.

Example. Let the Length of a Ship's Keel be 80 Feet, the Breadth 30, and half Breadth or Depth in the Hold 15, I demand its Burthen in Tuns?

Operation.

Operation. Length 80 Breadth 30 Square 2400 Half Breadth 15 12000 2400

94)36000(383 feré Tuns.

By the Sliding Rule.

By the Sliding Rule.

As 1 is to 80, fo is 30 to 2400. Unity. Length. Breadth. 4th Numb. 2. As 1 is to 2400, fo is 15 to 36000. Unity. 4th Numb. Depth. 5th Numb.

3. As 94 is to 1, so is 36000 to 383 Tuns feré. Divisor. Unity. 5th Numb. Answ.

But more expeditiously on the Lines C and D by Help of

the Gauge Point 9.69.

First find a Geometrical Mean between the Length 80, and Breadth 30, as is taught in Part I. on Page 43, which is 49 nearly.

Now say,
D. C. D. C.
As 9.69 is to 15, so is 49 to 383 Tuns.
Gauge Pt. Depth. Mean. Content.

Having the Dimension of one Ship, together with the Burthen thereof, to find the Dimensions of another Ship of any other Burthen greater or lesser than the given Ship.

### The RULE.

The Rule,

Divide the Burthen of one Ship by the Burthen of the other, (it matters not whether the given Ships Burthen be greater or leffer than the Ship required) and extract the Cube Root of the Quotient; multiply the Dimensions of the given Ship by this Cube Root, and the three several Products shall be the Dimensions of the other Ship, if its Burthen was greater than the Burthen of the given Ship: But if it was leffer, then divide the Length, Breadth, and Depth in the Hold by the Cube Root of the Difference of their Burthens (as above directed) the three several Quotients are the Dimension of the other Ship leffer than the given one.

Example. Let the Length of a Ship's Keel be 45 Feet, the An Example. Breadth of the Midship-Beam be 17.3, and the Depth in the Hold 8.7 Feet, the Content of this 72 Tuns, I demand the Dimensions of another Ship, whose Burthen shall be 360 Tuns?

### Operation.

Operation,

By

Burth. Quot. Cube Root.
72.)360(5.(1.71 is a common Multiplier.

Breadth.	Depth.
	8.7
1.71	1.71
<del></del>	
173	87
1211	609
173	87
29.583	14.877
	17.3 1.71 173 1211 173

By the Sliding Rule. By the Sliding-Rule, on the Lines D and E.

First, for the Length of the Keel, E. D. E. D. As 72 is to 45, so is 360 to 77. Content. Length. Content. Length.

Second, For the Breadth of the Midship Beam.

E. D. E. D.

As 72 is to 17.3, so is 360 to 29.5.

Content. Breadth. Content. Breadth.

Lastly, for the Depth of the Hold.

E. D. E. D.

As 72 is to 8.7, so is 360 to 14.9.

Content. Depth. Content. Depth.

Suppose there be given, the Mould and Burthen of one Ship, how to find another Ship of the same Mould of any assign'd Burthen greater, or lesser.

The Rule.

### The RULE.

The Length, Breadth and Depth of the Ship taken in Feet, multiply the Cubes of those Dimensions by as many as you would have the other Ship bigger than the given Ship, and the Cube Roots of these Products are the Answer.

A fecond Rule.

Or.

If you would have another Ship leffer than the proposed Ship, then divide the Cube of those Dimensions by 1, 2, 3, &c. the Cube Roots of those Quotients are the Dimensions of the other Ship so much leffer than the given Ship.

An Example.

Example. Admit a Merchant Ship, whose Burthen is 72 Tuns, the Length of the Keel 45 Feet, the Breadth of the Mid-ship Beam 17.3, and the Depth 8.7, and it is required to build another Ship, whose Burthen shall be 5 Times greater than the Ship given, I demand what must be the Dimensions of the Ship required?

Operation.

Operation,

	Operation.	
Length.	Breadth.	Depth.
45	17.3	8.7
45	17.3	8.7
225	519	609
180	1211	696
	173	
2025		75.69
45	299.29	8.7
	17.3	
10125		52983
81001	89787	60552
	209503	
91125	29929	658.503
5		5
	5177.717	
455625(76.9	5	3292.515(14.877
	25888.585(29.5	:83

{ Length 76.9 Breadth 29.583 } & The feveral Cube Roots are the Anfwer,

By the Sliding Rule.

By the Sliding

Multiply the Numbers feverally one into another on the Rule.

Lines A and B. and also by 5 as is taught in Page 14. then fet the Lines D and E even, then against the Cube on the Line E, is the Root on the Line D.



CHAP.

### CHAP. XVI.

Containing new Tables for a Gauger's Salary at 50 l.

per Annum for the common Year, or 365 Days; and for
the Leap Year, or 366 Days; with their Explanation, Confiruction, and Use. Also a Table for finding the Number
of Days for any Time assigned; with a Table of proper Multiplicators for Salaries, from 5 to 1000 l. per Annum.

A new TABLE, shewing a Gauger's Salary for every Day in the common Year at 50 l. per Ann. Calculated by C. Leadbetter.

Days			Jun	e.				Jul	y .		August.				
1 2 3 4 5	1. 46 46 47 47 47	s. 16 19 2 5 7	d. 11 8 5 2 11	2		/. 0 1 1 1	s. 19 1 4 7	d. 2 11 7 4 1	q. 0: 0: 3: 3: 2:	200 20 205 25	1. 5 5 5 5 5	s. 4 6 9 12	10 7	3:	_
6 7 8 9 10	47 47 47 47 48	10 13 16 18 1	8 5 1 10 7	3:	320 140 325 145 330	I I I 2 2	12 15 18 1	10 7 4 1	2: 1: 0: 0:	35 220	566666	17 0 3 6 8	96309	2: 1: 1:	290 110 295 115 300
11 12 13 14 15	48 48 48 48 48	4 7 9 12 15	4 1 10 7 4	1:	335 155 340 160	2 2 2 2	6 9 12 14 17	6 3 0 9 6	3:	225 45 230 50 235	6 6 6 7	11 14 16 19 2	6 2 11 8 5	3:	120 305 125 310 130
16 17 18 19 20	48 49 49 49 49	18 0 3 6 9	0 96 3 0	3:	345 165 350 170 355	3 3 3 3	0 3 5 8 11	3 0 9 5 2	1: 0: 3: 3:	55 240 60 245 65	77777	5 7 10 13 16	2 11 8 5	0:	315 135 320 140 325
21 22 23 24 25	49 49 49 50 0	11 14 17 0 2	96 3 0 8	0:	175 360 180	3 3 4 4	13 16 19 2 4	11 8 5 2	2: 1: 1:	250 70 255 75 260	7 8 8 8 8	18 1 4 7 9	7 4 1	2: 2: 1:	145 330 150 335 155
26 27 28 29 30 31	00000	5 8 10 13 16	5 2 11 8 5		363 190 10 195 15	4 4 4 4 5	7 10 13 15 18	8 4 1 10 7 4	3:	80 265 85 270 90 275	8 8 8 9 9	12 15 18 0 3 6	7 4 0 9 6 3	0 3: 3: 2:	340 160 345 165 350

Days	S	eptember.		C	) Et o	ber.		1	1	Vove	mber.	
1 2 3 4 5	1. s. 9 9 9 11 9 14 9 17	9 1: 175 6 0: 360 3 0: 180	1. 13 13 13 13	5. 11 13 16 19 2	d. 2	2 2 1	365 65 250 70 255 75	17 17 18 18 18	s. 16 18 1 4 7	10 7	3:3:3:3:1:2:3:	25 45 30 50 35
6 7 8 9	10 2 10 5 10 8 10 10	5 3: 5 2 2:190 11 2: 10	14 14 14 14	4 7 10 13 15	11 8 4 1	3:	265	18 18 18 18	9 12 15 18	10 7 4 0 9	3:34	40
11 12 13 14 15	10 16 10 19 11 1 11 4 11 7	2 0 : 200 11 0 : 20 7 3 : 205	14 15 15 15	18 1 4 6 9	7 4 1 10 7	I :	275 95 280	19 19 19 19	3 6 9 11 14	6 3 0 9 6	2:35 2:17 1:35 1:17 0:36	70 55 75
16 17 18 19 20	11 10 11 12 11 15 11 18 12 1	10 2: 30 7 1:215	15 15 15 16 16	12 15 17 0	3 0 9 6 3	3:	105	19 20 20 20 20	17 0 2 5 8	3 0 8 5 2	0:18 0:00 3:18 3:	35
21 22 23 24 25	12 3 12 6 12 9 12 12 12 14	10 0: 40 6 3: 225 3 3: 45 0 2: 230 9 2: 50	16 16 16 16	6 8 11 14 16	0 9 6 2	0:	115 300 120 305 125	20 20 20 20 21	10 13 16 19	11 8 5 2	1:19 1:1 0:20	5
26 27 28 29 30 31	12 17 13 0 13 3 13 5 13 8	6 1:235 3 1: 55 0 0:240 9 0: 60 5 3:245	17 17 17	19 2 5 7 10	8 5 2 11 8 5	2: 1: 1: 0:	310 130 315 135 320 140	21 21 21 21 21 21	4 7 10 12 15	7 4 1 10 7	3: 20 3: 2 2: 21 2: 3 1:21	500

Days	1	December.				1	7	anue	ary.		I	February.				
	1 1.	s.	d.	q.	365	1.	5.	d.	q.	365	1.	s.	d.	q.	365	
1	21	18	4	· I	35	26	3	3		: 295	30	8	2	2 :	190	
2	22	I	1	0		26	6	0		: 115	30	10	II	2 :		
3	22	3	10	0:	40	26	8	9	0		30	13	.8	I:	195	
4	22	6	6	3:	225	26	II	6		: 120	30	16	5	1:	15	
5	22	9	3	3 :	45	26	14	2	3	: 305	30	19	2	0:	200	
6	22	12	0	2 :	230	26	16	11	3	: 125	31	1	11	0:	20	
7 8	22	14	9	2:	50	26	19	8	2	: 310	31	4	7	3:	205	
8	22	17	6	1:	235	27	2	5	2	: 130	31	7	4	3:	25	
9	23	0	3	1:	33	27	5	2	1	0 )	31	10	I	2:	210	
10	23	.3	0	0:	240	27	7	11	1	: 135	31	12	10	2:	30	
11	23	5	9	0:	60	27	10	8	0:	320	31	15	7	1:	215	
12	23	8	5	3:	245	27	13	5	0	140	31	18	4	1 :	35	
13	23	11	2	3:	65	27	16	I	3 :	325	32	1	1	0:		
14	23	13	11	2:	250	27	18	10	3	145	32	3	10	0:	40	
15	23	16	8	2:	70	28	1	7	2 :	330	32	6	6	3:	225	
16	23	19	5	1:	255	28	4	4	2 :	150	32	9	3	3:	45	
17	24	2	2	1:		28	7	I	1		32	12	0	2:	230	
18	24	4	11	0:		28	9	10	1 :	155	32	14	9	2:	50	
19	24	7	8	0:	. 80	28	12	7	0:		32	17	6	1:	235	
20	24	10	4	3:	265	28	15	4	0:	160	33	0	3	1:	55	
21	24	13	1	3:	85	28	18	0	3 :	345	33	3	0	0:	240	
22	24	15	10	2:	270	29	0	9		165	33		9	0:	60	
.23	24	18	. 7	2:	90	29	3	6	2 :		33	8	5	3:	245	
24	25	I	4	1:	275	29	6	3	2 :		33	11	2	3:	20	
25	25	4	1	1:	95	29	9	0	1	355	33	13	11	2:	-	
26	25	6	10	0:	280	29	11	9	1	175	33	16	8	2:	70	
27	25	9	7	0:	100	29	14	6	0		33	19	5	1:	255	
28	25	12	3	3:	285	29	17	3	0	: 180	34	2	2	1:	75	
29	25	15	0	3:	105	30	0	0	0		-		-			
30	25	17	9	2:	290	30	2	8	3	: 185	-		-			
31	26	0	6	2:	110	30	5	5	3	5	-					

Days	I		Mai	rch.		I		Ap	ril.				M	ay.	
1 2 3 4 5	34 34 34 34 34	10	8 4	0	: 260 : 80 : 265 : 85	38 38 38 38	15	7 4	0 0 3	365 : 155 : 340 : 160 : 345 : 165	42 42 43	14	96	2 1	55
6 7 8 9 10	34 35 35 35 35	18 1 4 6 9	7 4 1 10 7	I	: 90 : 275 : 95 : 280 : 100	39 39 39 39 39	6	3 0 9	2 I I	350 : 170 : 355 : 175 : 360	43 43 43	~	9 5 2 11 8	3:	245 65 250
11 12 13 14 15	35 35 36 36 36	12 15 17 0 3	3 9 6 3	3 2	: 285 : 105 : 290 : 110 : 295	39 40 40 40 40	17 0 2 5 8	3 0 8 3 2	3 3	180 000 185 190		19 2 4 7 10	5 2 11 8 4	1:0:0:3:	260 80
16 17 18 19 20	36 36 36 36 36	6 8 11 14 16	0 9 6 2 11	1 0 3 3	300	40 40 40 40 41	10 13 16 19	5 2	2 I I O:	195	44 44 45 45	13 15 18 1	1 10 7 4 1	3: 2: 1: 1:	85 270 90 275 95
21 22 23 24 25	36 37 37 37 37	19 2 5 7	8 5 2 11 8	2 : 1 :	310 130 315 135 320	41 41 41 41 41	4 7 10 12 15	7 4 1 10 7	3:	210	45 45 45 45 45	6 9 12 15	10 7 3 0 9	o: 3: 3:	280 100 285 105 290
26 27 28 29 30 31	37 37 37 38 38 38	13 16 18 1 4	5 1 10 7 4 1	3:2:2:	145 330	41 42 42 42 42	18 1 3 6 9	4 1 10 6 3	1: 0: 0: 3: 3:	35 220 40 225 45	46 46 46 46 46 46	0 3 6 8 11	6 3 0 9 6 2	I: I: o:	110 295 115 300 120 305

A New TABLE, shewing a Gauger's Salary for every Day in the Leap-Year, at 50l. per Annum, Calculated by C. Leadbetter.

Days	June.	July.	August.				
I 2 3	1. s. d. q. 366 46 17 1 3:222 46 19 10 2:276 47 2 7 1:330 47 5 4 1:18	1. s. d. q. 366 0 19 1 2: 12 1 1 10 1: 66 1 4 7 0: 120 1 7 3 3: 174	1. s. d. q. 366 5 3 9 3: 222 5 6 6 2: 276 5 9 3 1: 330 5 12 0 1: 18				
5	47 5 4 I: 18 47 8 I 0: 72	1 10 0 2 : 228	5 14 9 0 : 72				
6 7 8 9 10	47 10 9 3: 126 47 13 6 2: 180 47 16 3 1: 234 47 19 0 0: 288 48 1 8 3: 342	1 12 9 1 : 282 1 15 6 0 : 336 1 18 3 0 : 24 2 0 11 3 : 78 2 3 8 2 : 132	5 17 5 3:126 6 0 2 2:180 6 2 11 1:234 6 5 8 0:288 6 8 4 3:342				
11 12 13 14 15	48 4 5 3: 30 48 7 2 2: 84 48 9 11 1: 138 48 12 8 0: 192 48 15 4 3: 246	2 6 5 1:180 2 9 2 0:240 2 11 10 3:294 2 14 7 2:348 2 17 4 2:36	6 11 1 3: 30 6 13 10 2: 84 6 16 7 1:138 6 19 4 0: 92 7 2 0 3: 246				
16 17 18 19 20	48 18 1 2:300 49 0 10 1:354 49 3 7 1:42 49 6 4 0:96 49 9 0 3:150	3 0 1 1: 90 3 2 10 0: 144 3 5 6 3: 198 3 8 3 2: 252 3 11 0 1: 306	7 4 9 2:300 7 7 6 1:354 7 10 3 1: 42 7 13 0 0: 96 7 15 8 3:150				
21 22 23 24 25	49 11 9 2: 204 49 14 6 1: 258 49 17 3 0: 312 50 0 0 0: 000 0 2 8 3: 366	3 13 9 0: 360 3 16 6 0: 48 3 19 2 3: 102 4 1 11 2: 156 4 4 8 1: 210	7 18 5 2:204 8 1 2 1:258 8 3 11 0:312 8 6 8 0:000 8 9 4 3:54				
26 27 28 29 30 31	0 5 5 2:108 0 8 2 1:162 0 10 11 0:216 0 13 7 3:270 0 16 4 2:324	4 7 5 0: 264 4 10 1 3: 318 4 12 10 3: 6 4 15 7 2: 60 4 18 4 1: 114 5 1 1 0: 168	8 12 1 2:108 8 14 10 1:162 8 17 7 0:216 9 0 3 3:270 9 3 0 2:324 9 5 9 2: 12				

Days		September.					(	) Et o	ber.			November.				
=	1.	5.	d.	9.	366	1.	s.	d.	0.	366	17.	5.	d.	9.	366	
1	9	8	6	1:		13	10	5	3:	222	17	15	2	1 :	66	
2	9	tı	3	0:		13	13	2	2:		17	17	11	0		
.3	9	13	11	3		13	15	11	1		18	0	7	3	174	
4	9	16	8	2 :		13	18	8	1		18		4	2 :	228	
5	9	19	. 5	1 :		14	1	5	0		18	6	1		282	
_	-	- 7				-		,	_		-					
6	10	2	2	0:	336	14	4	1	3 :	126	18	8	10	0:	336	
7	10	4	11	0		14	6	10		180	18	11	7	0:		
8	10	7	7	3 :	78	14	9	7	1 :	234	18	14	3	3:	78	
9	10	io	4	2 :	132	14	12	4	0:	288	18	17	0	2:		
10	10	13	1	1:	186	14	15	0	3 :	342	18	19	.9	1:	186	
-						-		*	-		-		-		1 3 4 3	
II	10	15	10		240	14	17	9	3 :		19	2	6	0:		
12	10	18	6	3:	1	15	Ò	6	2 :	7.81	19	5	2	3:		
13	11	İ	3	2:		15	3	3	1:	-	19	7	11	2:		
14	11	4	0	2:		15		0	0:		19	10	8	2:	-	
15	11	6	9	1 :	90	15	8	8	3 :	246	19	13	5	1:	90	
16	11	9	6	Ó I	144	15	11	5	2:	300	19	16	. 2	à:	144	
17	11	12		3:		15	14	2	1 :	-	19	18	10	3:		
18	11	14	ii	2:		15	16	11	1:		20	1	7	2:	-	
19	ıi	17	. 8	i:		is	19	8	0:		20	4	4	1:	306	
20	12	ó	5		360	16	2	4	3:		20	7	i	0:		
-	_					-		-	-		-	-			_	
21	12	3	2	o:	48	16	5	1	2:	204	20	9	10	0:	48	
22	12	5	10	3:		16	7	10		258	20	12	6	3:	102	
23	12	8	7	2:	156	16	10	7		312	20	15	3	2:	156	
24	12	11	4		210	16	13	4		000	20	18	0		210	
25	12	14	1	Õ:	264	16	16	0	3:	54	21	0	9	0:	264	
26	12	16	96		318	16	18	9	2:	108	21	3	5		318	
27	12	19		3:		17	. 1	6	1:		21	6	2	3:	6	
28	13	2	3	2:	60	17	4	3	0:		21	8	11	2:	60	
29	13	5.	0	1:	114	17	6	II	3:		21	11	8	1:	114	
30	13	7	9	0:	168	17	9	8	2:		21	14	5	0:	168	
31	-			-	-18-00	17	12	5	2:	12	1					

Days	I	D	ecen	iber			F	anuc	ary.		February.					
I 2 3 4 5.	1. 21 21 22 22 22	s. 17 19 2 5 8	d. 1 10 7 4	q. 3: 2: 1:		1. 26 26 26 26 26 26	s. 1 4 7 10	d. 10 7 3 0	1:0:3:	174	1. 30 30 30 30 30	s. 6 9 12 14	d. 6 3 0 9 5	2 I I	: 7	6 8 2
6 7 8 9 10	22 22 22 22 22 23	10 13 16 19	96308	3: 2: 1: 0: 3:	180 234 288	26 26 27 27 27 27	15 18 0 3 6	6 3 11 8	0: 0: 3: 2: 1:	24	31 31 31 31	0 2 5 8 11	2 11 8 4 1	2 1 0 3 3	: 18 : 23 : 28 : 34 : 3	88
11 12 13 14 15	23 23 23 23 23	4 7 9 12 15	5 2 11 8 4	3: 2: 1: 0: 3:	138	27 27 27 27 28	9 11 14 17 0	2 10 7 4 1	0: 3: 2: 2: 1:	294	31 31 31 32 32	13 16 19 2 4	10 7 4 0 9	1 0 3	: 8 : 13 : 19 : 24 : 30	6
16 17 18 19 20	23 24 24 24 24	18 0 3 6 9	1 10 7 4 0	2: 1: 0: 3:	354 42 96	28 28 28 28 28	2 5 8 11 13	10 6 3 0 9	0: 3: 2: 1:	198	32 32 32 32 32	7 10 13 15	6 3 0 8 5	1 0 3	: 35 : 4 : 9 : 15 : 20	6
21 22 23 24 25	24 24 24 25 25	11 14 17 0	9 6 3 0 8	2: 1: 0: 0: 3:	204 258 312 000 54	28 28 28 29 29	16 19 1 4 -7	6 2 11 8 5	0: 3: 2: 1:	48 102 156 210 264	33 33 33 33 33	1 3 6 9 12	2 11 8 4 1	0 0 3	: 25 : 31 : 000 : 5	2 0 4
26 27 28 29 30 31	25 25 25 25 25 25 25	5 8 10 13 16	5 2 11 7 4 1	2: 1: 0: 3: 2:	108 162 216 270 324 12	29 29 29 29 30 30	10 12 15 18 1	1 10 7 4 1	3: 3: 2: 1:	318 6 60 114 168 222	33 33 34 34	14 17 0 3	10 7 3 0	3	: 16: : 210 : 270 : 324	6

Days	-	i	Mar	cb.		1		Ap	ril.				M	ay.	•
1 2 3 4 5	1. 34 34 34 34 34	s. 5 8 11 13 16	d. 9 6 3 11 8	q. 2: 1: 0: 3: 2:	366 12 66 120 174 228	1. 38 38 38 38 39	s. 10 13 15 18	d. 5 2 11 8 5	-	330	1. 42 42 42 43 43	5. 12 15 17 0	d. 5 2 11 7 4	2: 1: 0: 3:	366 12 66 120 174 228
6 7 8 9	34 35 35 35 35	19 2 4 7 10	5 2 11 7 4	1: 0: 0: 3: 2:	282 336 24 78 132	39 39 39 39 39	4 6 9 12 15	1 10 7 4 0	2:	234	43 43 43 43 43	6 8 11 14 17	1 10 7 3 0	o: o: 3:	282 336 24 78 132
11 12 13 14 15	35 35 35 36 36	13 15 18 1	1 10 6 3 0	1: 0: 3: 2:	186 240 294 348 36	39 40 40 40 40	17 0 3 6 8	96308		84	43 44 44 44 44	19 2 5 7 10	9 6 2 11 8	1: 0: 3: 2:	186 240 294 348 36
16 17 18 19 20	36 36 36 36 36	6 9 12 14	9 6 2 11 8	1: 0: 3: 2: 1:	90 144 198 252 306	40 40 40 40 41	11 14 16 19 2	5 2 11 8 4	2: 1: 0: 3:	354 42 96	44 44 44 45 45	13 16 18 1 4	5 2 10 7 4	1: 0: 3: 2: 1:	90 144 198 252 306
21 22 23 24 25	37 37 37 37 37	0 3 5 8 11	5 2 10 7 4	0: 0: 3: 2: 1:	360 48 102 156 210	41 41 41 41 41	5 7 10 13 16	1 10 7 4 0	2:0:0:3:	258 312 000	45 45 45 45 45	7 9 12 15 18	1 10 6 3 0	o: 3: 2:	360 48 102 156 210
26 27 28 29 30 31	37 37 37 38 38 38	14 16 19 2 5 7	1 9 6 3 0 9	0: 3: 3: 2: 1:	264 318 6 60 114 168	41 42 42 42 42	18 1 4 6 9	9 6 3 11 8	2: 1: 0: 3: 2:	216	46 46 46 46 46 46	0 3 6 8 11	9 5 2 11 8 5	3: 3: 2: 1:	264 318 6 60 114 168

Explanation of the The EXPLANATION and USE of the Cash Tables for Salary.

Each Page contains three Columns, and in each Column there are five Rows of Figures; the first on the Left Hand is Pounds, the fecond Shillings, the third Pence, the fourth Farthings, and the fifth is Fractional Parts of a Farthing, whose Denominator in a Common Year is 365, the Days in the faid Year; and the Denominator belonging to those Numerators in a Leap Year is 366, the Days in the said Year.

One Example or two will make all plain.

An Example.

Example. In a Common Year what Salary has an Officer

due to him the 25th of July at 50 l. per Annum?

Look for the 25th of July in the Table for a Common Year, and over-against it you will find 4 l. 4 s. 11 d. 0 q.: 260, which Fraction is  $\frac{2.60}{3.63}$ , that is two thirds Parts of a Farthing.

If the Officer be remov'd out of one Collection into another, then out of this Salary you are to deduct the Charity\*, which is 3 d. per Pound. Thus by the Rule of Three Direct.

1.	d.	l. s. d. q.
If 1-	3	4 4 11 1
20		20
-		
20		84
12		12
-		
40		179
20		84
		<del></del>
240		1019
4		. 4
16 060 0		
If 960 q	—3.d.—	4077 9.
		3
		960)12231 (12 d.
		960
		2631
		1920
		Daniel and
		Remains 711
		4
***		960)2844(2 9.
		1920

Answer 1 s. od. 29. 924 Remains 924

<sup>\*</sup> See the End of Chap. XIX. Part II.

Now, this 1 s. 0 d. 2 q.  $\frac{9\cdot24}{9\cdot60}$  fubtracted from the Salary in the Table, viz. 4 l. 4 s. 11 d.  $\frac{1}{4}$  ferè, the Remainder 4 l. 3 s. 10 d,  $\frac{1}{4} \frac{26\cdot2740}{35\cdot0400}$  is the exact Salary that the Officer is to receive the 25th of July at 50 l. per Annum; the like observe for any other Day in the Year.

After what I have here faid concerning the Use of the Table for a Common Year, it is needless to trouble the Reader with any Examples of the Use of the Table for the Leap Year,

it being in all Respects the same.

The Construction of the aforegoing Tables is this:

First, by the single Rule of Three Direct, I find what is Conftruction of the Salary for one Day at 50 l. per Annum, thus,

Common Years

Answer 2 s. 8 d. 3 q. 185.

Having thus found that 2 s. 8 d. 3 q.  $\frac{185}{365}$  is the Salary due for one Day, which I place over-against the 25th Day of June, (because that is the first Day in the New Year according to the Excise) and adding the same Sum 365 Times, produces the Salary due every Day in a Common Year, as you see it plac'd in the Table.

After the same manner is the second Table calculated for Construction of the Salary due each Day in a Leap Year; only instead of 365, the Tables for a take 366 Days, and then work as before, and the Answer Leap Year.

will be 2 s. 8 d. 3 366. But

F 3

Becauf

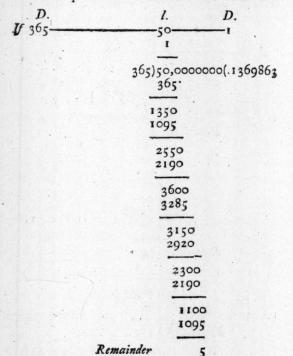
# Me of the Salary Cables. Part II.

Because these Tables and the Construction thereof is grounded upon Vulgar Arithmetick, I will in the next Place shew how to find a Decimal, which shall be a common Multiplicator, and which being multiplied by any Time respectively, shall produce the Salary due for that Time, either for Days or Weeks; the Product being reduc'd according to Page 7. Part I.

Common Multiplier how found. The Decimal or common Multiplier for a Day, &c. is no more than the Decimal of 2s. 8d.  $3q.\frac{185}{365}$  for a Common Year; and the Decimal of 2s. 8d.  $\frac{54}{365}$  will be a common Multiplier for a Day in the Leap Year.

Operation.

The Operation for a Common Year stands thus.



By the last Operation I find that .1369863 is a common Multiplicator for a Gauger's Salary; which multiplied by any Number of Days, produceth the Salary for that Time.

An Example,

Example. What Salary is there due to an Officer on the 29th Day of August in a Common Year.

Operation.

Operation.

n.	Operation
	fune 6 Common N fuly 31 Number of lug. 29
8219178 8219178	Days 66
Pounds 9.0410958	<b>6</b> )*
hillings 0.8219160	
16438320 8219160	
Pence 9.8629920 4	

Farthings 3.4519680

Answer 9 l. os. 9 d. 3 q. 451968, exactly agreeing with the Table for a Common Year.

Note. On Page 92, I have furnished you with two Tables A Note. of proper Multiplicators for Salaries, at several Rates per Annum, the one for a Common, and the other for a Leap Year.

But if the Officer be removed, &c. out of one Collection into another; then when you have multiplied your Number of Days by the common Multiplier 1369863, multiply that Product by this Decimal .9875, and it shall deduct you the Cha-How to deduct rity from the Salary.

Example. The Gross Salary for the 29th of August is found An Example. to be (either by the Tables, or by the foregoing Operation) 9.0410958, which I multiply by .9875.

# Ale of the Salary Tables. Part II.

See the Work.

First Product Common Multiplier

9.0410958 .9875

452054790 632876706 723287664 813698622

Pounds

8.92808210250

Shillings 18.561642050

112328410 56164205000

Pence 6.7397046

Farthings 2.9588184

Answer 81. 18 s. 6d. 1.9588184, is the Officer's neat Salary on the 29th Day of August.

A Note.

Note. If you would know the Reason of this Decimal .9875, which will always be a common Multiplier in this Case, it is the Decimal of 19 s. 9 d. for I deducted 3 d. from one Pound, and the Remainder is 19 s. 9 d. whose Decimal is a common Multiplier, as is shewn before, and the Decimal of one Day's Salary in the Leap Year is thus found.

> D. If 366

Work according as I have shew'd in Page 86, and you will find the Quotient to be .136612, which is a common Multiplier in this Cafe.

An Example,

Example. What Salary is there due to an Officer on the 29th Day of February in the Leap Year.

Cast your Eye on the Table for a Leap Year, and you'll find it to be 341. 3 s. od. 2 9.324. But

To work it Decimally, and deduct the Charity, the Ope Operation. ration stands thus.

June 67 July 31	Common 1	Multiplie	er. 136612 250
Aug. 31 Sept. 30 Oct. 31	<b>}</b>		6830600
Nov. 30 Dec. 31 Jan. 31 Feb. 29	Common Multipliers for C	Pounds harity	·34153 ·9875
Pays 250			
	Pounds	33.726	0875
	Shillings	14.52	175
			4350
	Pence	6.20	61
	Farthings	1.04	4
	Answer 331. 14 s. 6 d	1 9.:	044.

Note. The Manner of finding the Number of Days may be A Note, more expeditiously perform'd by the Table on Page 90.

The further Use of these Salary Tables will appear in Case A further Use of an Officer's Discharge, &c.

Example. Suppose an Officer has received Salary to An Example, August 11, and on the 2d of September following he is discharg'd; I demand what Salary he has to receive for that Time in a Common Year?

Look into the Table for a Common Year, and take out the neat Salary to August 11, (that is by deducting the Charity) and I find it to be 6 l. 9 s. 10 d. 19. 4245952.

Also take out the neat Salary to Sept. 2. and it is 9 l. 9 s. 4 d. 2 q. 4108680.

The Difference of these two Sums is 21. 19 s. 6d. 0 q. 9862728 the neat Salary then due to the Officer, and so of any other.

These Tables I calculated for my own private Use; but now I make them publick for the Good of my Country.

A Table for finding the Number of Days for any Time affigned.

# A TABLE for finding the Number of Days for any Time assigned.

		t tof		
			Feb. Mar. Apr.	Jan.
334	212. 243. 273.	151.	31. 59. 90.	. 31.
Jan.	Nov Nov	July Aug	Mar. Apr. May	Feb.
334-	212 242. 273	150.	. 28. 59. 89.	200
Feb.	Nov Dec	Aug Sept	Apr. May June	Mar
337.	214.	153	31. 61. 92.	Mar. 31.
Mar.	Dec.	Aug Sept.	May June July	Apri
306.	275	153	30. 61. 91.	April 30.
Apr.	Dec. Jan. Feb.	Oct.	July Aug	May
	214. 245. 276.			31.
Apr. May	Jan. Feb. Mar	Nov. Dec.	July Aug. Sept.	June 30.
304.	214. 245. 273.	153. 183.	30. 61. 92.	30.
June 3	Feb. Mar Apr	Dec. Jan.	Aug. Sept. Oct.	July 31.
35	215. 243. 274.			31.
			Sept. Oct. Nov.	Aug.
			31. 61. 92.	31.
Aug.	Apr. May June	Feb. Mar.	Oa. Nov.	Sept.
	212. 242. 273.			30.
Aug. Sept.	May June July	Mar. Apr.	Nov. Dec. Jan.	OA.
335	212. 243. 273.	151.	31. 61. 92.	31.
oet.	July Aug.	Apr. May	Dec. Jan. Feb.	>
334	212. 242. 273.	151.	vv. 31. Dec. 30. Jan. 31. cc. 61. Jan. 61. Feb. 62. n. 92. Feb. 92. Mar. 90.	lov. 30. Dec. 31.
Nov.	July Aug. Sept.	May June	Jan. Feb. Mar.	Dec.
304.	212. 243. 274.	151.	31. 62. 90.	31.

The Explanation and Use of the foregoing Table.

This Table is to affift the Officer in calculating the Salary The Use of the due to him, to any Day of his Removal from one Collection foregoing Table, to another, or in Case of a Discharge.

Example 1. Suppose an Officer is removed the 8th Day Example 1. of November from Leverpool, to Worcester, and has received

his Salary to September the 8th last past.

Look on the Top of the Table for September, and keep your Eye down the fame Column, 'till you find November, and there you will fee placed 61; which shews you that there are 61 Days from the 8th of September to the 8th of November, and so of any other Months, and same Day of the Month.

Example 2. How many Days are there from the 29th of Example 2.

April to the 17th of August?

Look on the Top for April, and guide your Eye down 'till you come to August, where you will find 122, which are the Days from the 29th of April to the 29th of August; then because 17 wants 12 of 29, subtract 12 Days from 122, and there remains 110 Days, and so many Days there are from April 29, to August 17, following.

Example 3. I would know how many Days there are from Example 3.

February the 14th to July the 25th?

Look on the Top for February, and down the same Column against July is 150, (that is to July the 14th,) but because I want to know the Number of Days from February 14. to July 25, which is 11 Days more, 11 Days added to 150 make 161, and just so many Days there are from February the 14th to July the 25th.

Note. When Leap Year happens, and February is included A Notes in the Days required, one Day more must be added than is

in the Table, February then having 29 Days.

N.B. This Table is useful in computing the Time for Servants Wages, and for all Manner of Salaries, of what Time or Rate foever.

See likewife the Examples of the Salary Tables following.

# Proper Multiplicators for Salaries, in a Common Year.

PerAn.	Per Diem.	r Diem. Value. PerAn		Per Diem.	Value.		
1.	Decimals.	i. s. d.	1.	Decimals	1. s. d.		
5	.013698	0:0: 34	90	.246575	0: 4:114		
10	.027397	$0:0:6\frac{i}{2}$	100	.273972	0: 5: 5\fere		
15		0:0:10 fere.	120	.328766	0: 6: 7 ferè		
20	.054794	0:1:1	200	-547974	0:10:11		
25	.068493	0: 1; 41 fere.			0:16: 54		
30	.082191		400		1: 1:11		
40	.109589	0:2: 21	500	1.369863	1: 7: 41		
50	.136986	$0:2:8\frac{3}{4}$			1:12:101		
52	.142465	0:2:104	700	1.917808	1:18: 44		
60	.164383	$0:3:3\frac{3}{4}$	800	2.191896	2: 3:10		
70		0:3:10	900	2.465811	$2:9:3\frac{1}{2}$		
80	.219178	0:4: 41	1000	2.739726	2:14: 91		

### Proper Multiplicators for Salaries in a Leap Year.

Per An. Per Diem.		er An. Per Diem. Value.		An. Per Diem Value. Per An. Per Diem		Value.				
1.	Decimals.	l. s. d.	1.	Decimals.	1. s. d.					
5	.013661	0:0: 34	90	-245901	0: 4:11					
10	.027322	0:0:61	100	.273224	0: 5: 51					
15	.040983	0:0:10 ferè	. 120	327869	$0: 6: 6\frac{3}{4}$					
20	.054645	0:1:1	200	.546448	0:10:11					
25		0:1: 44	300	.819672	0:16: 43 fere					
30		0:1: 71	400	1.092896	1: 1:104					
40		0:2: 21 feri	. 500	1.366119	1: 7: 34					
50	.136612	$0:2:8\frac{3}{4}$		1.639344	1:12:101 fere					
53	.142076	0:2:10	700	1 912568	1:18: 3					
60	.163934	0:3: 34			2: 3: 81					
70	.191256	$0:3:9\frac{3}{4}$	900	2.459016	2: 9: 21 fere					
80		0:4: 41 feri	1000	2.732240	2:14: 74 ferè					

### The Use of the two Tables of Multiplicators for Salaries.

Having by the Table on Page 90. found the Number of Days required, those Days multiply'd by the proper Factor will give the Salary due.

Example. What Salary is due to an Officer for 40 Days, at 50 l. per Common Year ? Anfaver 5 1. 9 s. 7 d. 0 9.2624.

Example. What Salary is due to a Supervisor for 45 Days, at 90 %. per Leap Year? Anfwer 11 1. 1 s. 3 d. 29.9202. CHAP.

### CHAP. XVII.

Concerning the STANDARD Winchester BUSHEL and GALLON kept in his Majesty's Exchequer; shewing when and how their Contents were settled by Att of Parliament. Also the STAN-DARD Averdupoize and Troy Weights kept in the Exchequer, compared with each other, and with the faid Bushel, Half Bushel, Peck and Gallon, wirb Tables for finding whether the Content of any of the faid Measures are equal to the Standard, or not, when their Diameter or Depth vary from it.

AVING in the first Part on Page 148, and of the Winebolte elsewhere, declar'd what the Content of the Win-Bushel. chester Bushel is, &c. yet I shall here, for the Satisfaction of the inquisitive Reader, give an Account how the Content of the faid Bushel came to be ascertain'd.

By the Statute of the 11th Hen. VII Cap. 4. it is Enac-x1 Hen. VII. ted, that Standard-Weights and Measures be made and fent chap. 4. to the feveral Cities, Boroughs, and Market-Towns therein mentioned, which was accordingly done. But the Statute of the 12th Henry VII. Cap. 5. recites, that upon more diligent 12 Hen. VII. Examination, the faid Standard-Weight and Measures were chap. 5. found defective: And Enacts, that the Measure of a Bushel shall contain eight Gallons of Wheat, and that every Gallon contain eight Pounds Troy of Wheat, and that every Pound contain 12 Ounces Troy-Weight, and every Ounce contain 20 Sterlings (now 20 Penny-weight,) and every Sterling, or Penny-weight, be of the Weight of 32 Corns of Wheat, that grew in the Middle of the Ear of Wheat, and that a Standard of a Bushel and a Gallon after this Affize be made and kept in the King's Treasury for ever: And new Bushels and Gallons were order'd to be made, and fent to the feveral Cities, Boroughs, &c. and the old ones brought back and broken.

Accordingly; there remains now in the Custody of the Standard Bushel Chamberlain of the Exchequer, a Standard Brass Bushel, and and Gallons in a Standard Gallon agreeing thereto: Upon the Bushel there is whose Custedy.

this Infcription,

Henricus Septimus, Dei Gratia, Rex Anglia & Francia.

An Experiment to ascertain the Content of the Standard Bushel.

In February 1696, when a Bill was depending in Parliament for laying a Duty on Malt, Mr. George Tollet, Mr. Phil. Shales, Mr. Tho. Jett, and Mr. Thomas Everard, in the Presence of several Members of the House of Commons, did make an Experiment in Order to find the true Content of the faid Standard Bushel in the Exchequer; and the faid Brass Bufbel being exactly fill'd with common Spring Water, and the faid Water being measur'd out again by a regular Parallelipipedon\*, whose Base was four Inches Square, and the Depth 14 Inches, was found to contain 2145.6 Solid Inches; the faid Water was also weigh'd by the Standard Weights in the Exchequer, and by a Beam which wou'd turn with fix Grains, with 30 Pounds in each Scale, and found to be 1131 Ounces and 14 Penny-weight Troy.

The Diameter

Now to fettle the Dimensions for a Bushel to answer the and Depth why faid Standard, these were agreed upon as most convenient, viz. fettled as they now 18.5 Inches Diameter, and 8 Inches deep, for a Cylindrical Vessel of these Dimensions will contain 2150.42 solid Inches. which exceeding the Content of the Standard Bushel but 4.82 Inches, and there being no other convenient Dimensions without counting to the Hundredth Part of an Inch, that would come fo near as these, it was enacted in the Act for laying a Duty upon Malt.

The Description of the Bushel.

That every Round Bushel with a plain and even Bottom, being eighteen Inches and a half (throughout) Diameter, and eight Inches deep, shall be esteem'd a legal Winchester Bushel, according to the Standard in his Majesty's Exchequer.

Of the Standard

When this Experiment was made at the Exchequer, the faid Gentlemen also compar'd the Standard Troy-Weights Averdupoize and with the Standard Averdupoije were equal to 18 Pounds, 2 Ounces, and Troy Weights in Pound Averdupoife were equal to 18 Pounds, 2 Ounces, and with the Standard Averdupoise-Weights, and found that 15. 15 Penny-weight Troy; so that 140 Ounces Averdupoise are equal to 218.75 Ounces Troy, which in the least Terms in whole Numbers are as follows,

Averdupoise.	Troy.
192	175 Ounces.
144	175 Pounds.

The Bushel as now settled, contains 2150.42 solid Inches, as was shewn Page 149, and will contain of common Spring-Water 1134.344 Ounces Troy: For

The Proportion.

As 2145.6 the Inches in the Brass Standard, Is to 1131.7 the Troy Ounces of Water it contain'd, So is 2150.42 the Content of a Bushel as now settled, To 1134.344.

Hence

See how the Content of the Wine Gallon at Guildhall, London, was found by this Veffel, Page 163, Part I.

Hence the following Table shews the Content in folid Inc bes The Inches and Hence the following Table thews the Content in joing Inc. Des of a Bushel, half Bushel, Peck, and Gallon; and likewise the Water contain'd in a Bushel, &c. Weight of Water that each will contain

al e	Inches.	1b. oz. p.w.	Averdupoize. lb. oz. dr.
Bushel —	2150.42	94. 6. 6.88	77. 12. 8.60
Half Bushel	1075.21	47. 3. 3.44	32. 14. 4.30
Peck —	537.60	23. 7. 11.72	19. 7. 2.15
Gallon —	268 80	11. 9. 15.86	5. 11. 9.05

By this Table 'tis easy to make any of the Measures therein Use of the above mention'd, or to try fuch as are already made by the Help Table. of a good Pair of Scales and true Weights. But where thefe are not to be had, the following Table shews the Diameters and Depths, that will answer to the Bushel, half Bushel, Peck and Gallon, provided they be equally wide from the Top to the Bottom.

A TABLE for trying whether any Bushel, Half Bushel, Peck, or Gallon, be equal to the Standard.

1	-						The same of		•
	Buft	el.	1 B	isbel.	Pe	ck.	Ga	llon.	
	Diam.	Depth.	Diam.	Depth.	Diam.	Depth.	Diam.	Depth.	
	17.5 17.6 17.7 17.8 17.9 18.0 18.1 18.2 18.3 18.4	8.84 8.74 8.64 8.55 8.45 8.36 8.27 8.18	13.8 13.9 14.0 14.1 14.2 14.3 14.4 14.5	7·30 7·20 7·9 6·98 6·89 6·69 6·60 6·51 6·42	10.8 10.9 11.0 11.1 11.2 11.3	5.98 5.87 5.76 5.66 5.56 5.46 5.36 5.27 5.18 5.9	8.4 8.5 8.6 8.7 8.8 8.9 8.0 9.1	4.97 4.85 4.74 4.63 4.52 4.42 4.32 4.23 4.13 4. 4	0
	18.5 18.6 18.7 18.8 18.9 19.0 19.1- 19.2 19.3 19.4 19.5	7.91 7.83 7.75 7.67 7.58 7.50 7.42 7.35	14.8 14.9 15.0 15.1 15.2 15.3 15.4 15.5 15.6	6.34 6.25 6.17 6. 8 6.00 5.93 5.85 5.77 5.72 5.63 5.56	11.8 11.9 12.0 12.1 12.2 12.3 12.4 12.5 12.6	4.92 4.83 4.75 4.68 4.60 4.52 4.45 4.38 4.31 4.24	9·3 9·4 9·5 9·6 9·7 9.8 9·9 10.0 10.1 10.2 10.3	3.79 3.71 3.64 3.56 3.49 3.42 3.36 3.29	Stan- dard,

Stan-

### The USE of the foregoing TABLE.

Example 1.

Example 1. Suppose the Diameter of a Bushel be 19, and five Tenth Parts of an Inch: Find this in the first Column, and against it you have 7.20, that is seven Inches and almost a Quarter: Now if the Bushel be exactly so deep, it is a legal Bushel.

Example 2.

Example 2. Suppose the Diameter of a Bushel be 19 Inches, and the Depth but 7.1, you will find by the Table the Depth ought to be 7.58 Inches to be equal to the Standard; and therefore you may conclude such a Bushel is too little; now to find how much it wants, say

As 7.58 Inches the Depth in the Table, Is to 32. the Quarts in a Buffel, So is 7.1 the Depth of the Buffel given,

To 29.9 Quarts; that is Twenty-nine Quarts, and Nine Tenth Parts, which (is 30 Quarts fere;) fubtract from 32. and it leaves 2.1 Quarts, and fo much that Bushel is less than the Standard. The like Method may be observed for trying the Truth of the Half Bushel, Peck and Gallon.

A Note.

N.B. If the Bushel be not exactly round, and the Difference of the Diameters be not above an Inch, add the longest and shortest Diameters together, and take half the Sum for the mean Diameter, and proceed as above.

Example 3.

Example 3. But suppose you would have a Bushel 16 Inches Diameter, what Depth must it be to be equal to the Standard Bushel?

The Rule.

The RULE.

Divide Unity (or one Bushel) by the Area of the given Diameter, and the Quotient is the Depth that will make a Bushel of that Diameter.

See the Work.

Diameter 16 Inches.

96
16
Area.

Area. Depth.

2738)256.0000 (.0935) 1.00000(10.7

to 10 Inches and almost three Quarters, and so deep a Bushel must be, that is 16 Inches Diameter to be equal to the Standard.

CHAP.

But this is more expeditiously performed by the Sliding Rule on the Lines C and D, viz.

Set 16, the given Diameter on D to 1 upon C. and against the Gauge Point 52.32 on D. is 10.7 the Depth upon C, &c.

### CHAP. XVIII.

Containing, I. Cash Tables for Victuallers for the Excise of strong Beer and Ale at 5 s. per Barrel. II. Cash Tables for Victuallers for the Excise of small Beer, at 1 s. 4 d. per Barrel. III. Cash Tables for the Excise of strong Beer and Ale for Common Brewers in the Country, at 5 s. the Barrel. IV. Cash Tables for the Excise of small Beer for common Brewers in the Country, at 1 s. 4 d. per Barrel. V. VI. and VII. Cash Tables for Common Brewers in London. VIII. and IX. Cash Tables for Malsters from Cistern and Couch, and from the Floor.

Cash Tables for Victuallers for the Excise of strong Beer and Ale at 5 s. per Barrel, calculated to a Quarter of a Barrel, by C. Leadbetter.

Bar	. l. s. d.	Bar	r. 1. s. d.	Be	ar. l. s. d.	Ba	ar. 1. s. d.	B	ar. l. s. d.
1		1		11		11 :	7 11 3	11 .	10 1 3
2	0 1 3	2	2 11 3 2 12 6	2	5 1 3 5 2 6	1 2	7 11 3	2	10 1 3
3		3	2 13 9	3	5 3 9	3.	7 13 9	3	10 3 9
.1		11		21	5 2 9 0 3 6 9 0 3 6 9 0 3 6 9 0 3 6 9 0 3 6 9 0 3 6 9 0 3 6 9 0 3 6 9 0 3 6 9 0 3 6 9 0 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	31	7 11 3 7 12 6 7 13 9 7 15 0 7 16 3 7 17 6 7 18 9 8 00 0 8 1 3 8 2 6 8 3 9 8 5 6 3 8 7 6 8 8 9 8 10 0 8 11 3 8 12 6 8 13 9 8 15 0 8 16 3	41	10 1 3 10 2 6 10 3 9 10 5 0 10 6 3 10 7 6 10 8 9 10 10 0
1	0 5 0 0 6 3 0 7 6	1	2 16 3	1	5 63	1	7 16 3	1	10 63
2	0 7 6	2	2 15 0 2 16 3 2 17 6	2	5 76	2	7 17 6	2	10 76
3	0 8 9	3	2 18 9	3	5 8 9	3	7 18 9	3	10 89
2	0 10 0	12	3 00 0	22	5 10 0	32	8 00 0	42	10 10 0
1	011 3	1	2 18 9 3 00 0 3 1 3 3 2 6 3 3 9 3 5 0 3 6 3 3 7 6 3 8 9 3 10 0 3 11 3 3 12 6	1	5 11 3	1	7 18 9 8 00 0 8 1 3 8 8 2 6 8 8 3 9 8 10 3 6 8 11 2 6 8 11 2 6 8 13 0 0 3 6 8 16 3 6 8 17 9 9 10 3 6 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	1	10 11 3
2		2	3 2 6	2	5 12.6	2	8 2 6	2	10 12 6
3	0 13 9	3	3 3 9 3 5 0 3 6 3 3 7 6	3	5 13 9 5 15 0 5 16 3	3	8 3 9 8 5 0 8 6 3 8 7 6	3	10 13 9
3	0 15 0	13	3 50	23	5 15 0	33	8 50	43	10 15 0
1	0 16 3	1	3 0 3	1	5 16 3	1	8 0 3	1	10 16 3
2	0 17 6	2	3 7 0	2	5 17 6 5 18 9	2	8 70	2	10 17 6
3	0 18 9	3	3 2 6 3 3 9 3 5 0 3 6 3 3 7 6 3 8 9 3 10 0 3 11 3 3 12 6	3	5 18 9	3	8 8 9	3	
4	I 0 0	14	3 10 0	24	6 7 2	34	8 10 0	44	
2	I I 3 I 2 6	2.	3 11 3 3 12 6	1 2	6 1 3 6 2 6	2	8 11 3	2	11 13
3	1 3 9	3	3 13 9	3	6 2 0	3	8 13 9	3	11 3 9
	0 13 9 0 15 0 0 16 3 0 17 6 0 18 9 1 0 0 1 1 3 1 2 6 1 3 9 1 5 0 1 6 3 1 7 6 1 10 0 1 11 3 1 12 6 1 13 9 1 10 0 1 11 3 1 12 6 1 13 9 1 10 0	15	3 13 9 3 15 0 3 16 3 3 17 6 3 18 9		6 1 3 6 2 6 6 3 9 6 5 0 6 6 3 6 7 6 6 8 9	35	8 15 0	45	
5	1 6 3	1,0	2 16 3	25	6 6 3	33	8 15 0 8 16 3 8 17 6 8 18 9	I T	11 5 0 11 6 3 11 7 6
2	1 6 3	2	3 16 3	2	6 6 3 6 7 6 6 8 9 6 10 0	2	8 17 6	2	11 76
	1 8 9	3	3 18 9	3	6 8 9	3	8 17 6	3	11 8 9
6	1 8 9	16	4 00 0	26	6 10 0	36	9 00 0	46	11 8 9
1	1 11 3	1	4 1 3	1	6 11 3 6 12 6	1	9 1 3	1	11 113
2	1 11 3	2	4 1 3 4 2 6	2	6 12 6	2	9 1 3 9 2 6	2	11 11 3
3	1 13 9	3	4 3 9	3	6 13 9	3	9 3 9 9 5 0	3	
7	1 15 0	17	4 5 0	27	6 15 0	37	9 50	47	11 15 0
1	1 16 3	1	4 1 3 4 2 6 4 3 9 4 5 0 4 6 3 4 7 6 4 8 9 4 10 0 4 11 3	1	6 13 9 6 15 0 6 16 3 6 17 6 6 18 9	1	9 1 3 9 2 6 9 3 9 9 5 0 9 6 3 9 7 6 9 8 9 9 10 0	1	11 16 3
2	1 17 6	2	4 7 6	2	6 17 6	2	9 7 6	2	11 17 6
3	1 18 9	3	4 8 9	3	6 18 9	3	9 8 9	3	11 18 9
8	2 00 0	18	4 10 0	28	7 00 0	38	9 10 0	48	12 00 0
1	2 1 3 2 2 6	1	4 11 3	1	7 1 3 7 2 6	1	9 11 3 9 12 6	1	12 13
2	2 2 6	2		2	7 2 0	2	9 12 6	2	12 26
3	2 3 9	3	4 13 9 4 15 0 4 16 3	3	7 3 9	3	9 13 9	3	12 3 9 12 5 0 12 6 3 12 7 6
9	2 5 0 2 6 3	19	4 15 0	29	7 50	39	9 15 0	49	12 50
1	2 6 3	1	4 16 3	1	7 6 3	1	9 16 3	2	12 6 3
2		2	, 1 -/	2	7 7 8 9	3	9 17 6		12 8 9
3	2 8 9	3	4 18 9	30	7 1 3 7 2 6 7 3 9 7 5 0 7 6 3 7 7 6 7 8 9 7 10 0	40			11 13 9 11 15 0 11 16 3 11 17 6 11 18 9 12 00 0 12 1 3 12 2 6 12 3 9 12 5 0 12 6 3 12 7 6 12 8 9 12 10 0
10	2 10 01	201	3 00 00	301	10011	401	-0 00 01	,01	12 10 0

			3.					_					1134			
Bar	. l. s. d.	Bar			Ba	r. 1.		d.	Ba			d.	Be	ar.		
1. "	112.11 3	3	15		1	18			1 3	121	18	1	1	25		2
. 2	12 12 6	63	15		2	18			88	22			2	25		
3.	12 13 9	1	15		3	18		-	1	22		3	3	25		
151	12 15.0	2	15		176	119		0	. 2	22		, 6	IOI	1		0
1 5	12 16 3	3	15		1	119		. 3.	. 3	22		9	1	25		
2.	12 17 6	64	16		2	19			1 '	22		0	2	25		6
3	12 18 9	1	16	1 3	3	1-1-9			1	22		3	3	25		
132	13 00 0	2	16	26	×77	119	7		1.	2.2		6	102	1 1		
1	13 1 3	3	16	39	1	19		2	3	22		9	I	25		2
2	13 26	65	16		7	19		6	90	22		0	2	25		100
13.	13 - 3 9		16	6 3 7 6	3	19		9	1	22		3	3	25		
53	13 - 5 0	2	16		78	19	10	0	2	22		6	103	25		10.00
15		3	16	8 9	1	19	11	3	3	22	13	9	1 1	25	16	
2	13,76	66	1.6		2	19	12	6	9,1	22	15	0	2	25	17	6
3.		1	16	11 3	3	19	13	9	1	22	16	3	3	25	18	
54	13,100	2 .	16		, 79	19	15	0	2	22	17	6	104	26	00	
1	13 11 3	3	16	13 9	1	19	16	3	3	22	18	9	1			36
2	13 12 6	67	16	15 0	2	19	17	6	92	23	00	0	3	26	e	
3	13 13 9	I	16	16 3	3	19	18	9	1	23	1	3	105	26 26	3	9
55	13 15 0	2	15	176	80	20	00	0	2	23	2	6	1	26	3 5 6	
115	13 16 3	68	16	18 9	1	20		36	3	23	3	9	2	26		3
2	13 17 6		17	00 0	2	20	2	-3.10	93	23	5	0	3	26	7 8	9
3	13 18 9	'	17	1 3	3 81	20	3	9	2	23	7	36	106	26	10	0
56	14 00 0	2	17	26	2000	20	5	0	3	23	7 8		1	26	11	3
1	14 1 3	69	17	3 9	1	20	7	3		23	10	9	2	26	12	6
2	14 2 6	B 7 4	17	50	3	20	8		94	23	11	377	3	26	13	9
3	14 3 9	1 2	17		82	20	10	9	2	23	12	3	107	26	15	0
57	14 50	3	17	0	1	20	II		3	23	13	9	1	26	16	3
I o	14 6 3	70	17	100	2	20	12	6	95	23	15	9	2	26	17	6
2.		1	17	THE PARTY OF THE P	3	20	13		93	23	16	3	3	26	18	9
58	14 8 9	2	17	11 3	83	20	15	9	2	23	17	6	108	27	00	0
10 to 10 to	14 11 3	3	17	13 9	1	20	16	3	3	23	18.	9	1	27	1	3
2	13. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	71	17	15 0	2	20	17	6	96	24	CO	0	2	27	2	6
3		1	17	16 3	3	20	18	9	1	24	í	3	3	27	3	9
59.	14 13 9	2	17	17 6	84	21	00	0	2	24		6	109	27		0
139		3.	17	18 9	1	21	1	3	3	24		9	1	27	5	3
2	14 16 3	72	18	00 0	2	21	2	6	97	24		0	2	27	7	6
3	14 18 9	1	18	<b>以外发展第二次至6</b>	3	21		9	1	24	5	3	3	27	8	9
160	15 00 0	2.	18	1 3 2 6	85	21	5	0	2.	24		6	110	27	10	0
1	15 1 3	3	18	39	1	21	3 56 78	3	3	24		9	1	27	II	3
2	15 26	73	18		2	21	7	6	98	24		0	2	27	12	6
4		2		6 3	3	21	8		1	21	7 7	-	3		13	9
61	15 50	2	18	5 0 6 3 7 6 8 9	86			90	2	24	12	36	111	27 27 27 27 27 27 28	13 15 16 17 18	0
1	15 6 3	3	18	89	1	21	11	3	3	24	13	91	1	27	16	31
2	15 7.6	74	18	100	2	21	12	36	99	24	15	0	2	27	17	6
3	15 8 9	1	18	11 2	3	21 21	13	9	1	24	16	3	3	27	18	9
62	13 10 0	2	18 18 18 18 18	11 3	87	21	15	0	2	24	17	6	112	28	00	0
	15 3 9 15 5 0 15 6 3 15 7 6 15 8 9 15 10 0 15 11 3 15 12 6	3	18	12 6 13 9 15 0	1	2 I 2 I	10 11 12 13 15 16	0 36	3	24	12 13 15 16 17 18	91				1
2	15, 12, 6	75	18	15 0	2	21	17	6	100	25	00	of				_1
-	-	-	-											-	-	

# Ch.XVIII. Miduallers at 1 s. 4 d. per Barrel. 99

TABLE II.

See it explained on Page 108.

Cash Tables for Victuallers for the Excise of Small Beer at 15. 4 d. per Barrel, calculated to a Quarter of a Barrel, by C. Leadbetter.

pe				, , ,	., ., .		
Bar	· 1. s. d.	Bar. l. s. de	Bar. l. s.	d.    Bar	. l. s. d.	Bar.	1. s. d.
1	0 0 4	3 0 14 4 11 0 14 8 1 0 15 0	1 1 8 2 1 8	4 3 8 32 0 1 4 2 8 3 0 33	2 2 4	1	2 16 4
2	0 08	3 0 14 4 11 0 14 8 1 0 15 0 2 0 15 4 3 0 15 8 12 0 16 0 1 0 16 4 2 0 16 8		8 32	2 2 4 2 8	2	2 16 4 2 16 8
3	0 1 0	1 0 15 0	3 1 9	0 1	2 3 0	3	2. 17 0
1	0 1 4	2 0 15 4	22 1 9	4 2	2 3 0 2 3 4 2 3 8	-43	2 17 4 2 17 8
1	0 1 4 0 1 8 0 2 0	3 0 15 8	22 1 19 1 1 9 2 1 10	8 3	2 3 8	1	2 17 8
2		12 0 16 0			2 4 9	2	
3	0 2 4	1 0 16 4	3 I IC		2 4 4	3	2 18 4
2	0 3 0		23 1 10	0 3	2 4 Q 2 4 4 2 4 8 2 5 0	44	The state of the s
1	0 3 0 0 3 4 0 3 8	13 0 17 4	2 1 11		2 5 0	1 2	2 19 0
20	0 3 8	1 0 17 8	3 1 11	4 34	2 5 4 2 5 8	3	2 19 4 2 19 8
1	0 40	3 0 17 0 13 0 17 4 1 0 17 8 2 0 18 0 3 0 18 4	24 1 12		2 60	45	
1 2 3 3 3 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2 2 3 3 3 4 4 4 5 5 5 5 6 6 6 7 7 7 8 8 8 8 0 0 0 0 0 0 0 0 0 0 0 0 0	3 0 18 4	1 1 12		2 2 4 8 2 3 3 4 4 4 8 2 2 4 4 8 0 4 4 8 2 2 5 5 6 6 6 8 0 4 8 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	1 1	3 0 0 4 3 0 8 3 I 0 3 I 4 3 I 8 3 2 0 3 2 4 3 2 8 3 3 0 3 3 4
20	0. 4.8	14 0 18 8	2 1 12	3 4 3 35 3 4 2 3 3 6 4 1 1 4 8 2 2 0 3	2 6 4 2 6 8	2	3 0 4 3 0 8
	0 50	1 0 19 0	3 1 13	0 1	2 70	3	3 10
4	0 5 4	2 0 19 4 3 0 19 8	25 1 13	4 2	2 7 0 2 7 4 2 7 8	46	3 14
1	0 5 8	3 0 19 8	1 1 1	8 3	2 .78	1	3 I 4 3 I 8 3 2 0
2	0 60	15 1 00 0	2 1 14	0 36	2 80	2	3 20
5.	6 6 4	15 1 00 0 1 1 0 4 2 1 0 8 3 1 1 0	25 I I 2 I I I 2 2 I I 4 3 I I 4 26 I I 4	4 1	2 7 4 2 7 8 2 8 0 2 8 4 2 8 8 2 9 0	3	3 2 4 3 2 8
5.	0 0 0	2 1 0 8	26 1 14	8 2	2 8 8	57	3 . 2 8
1	0 7 0	1 0 19 0 2 0 19 4 3 0 19 8 15 1 00 0 1 1 0 4 2 1 0 8 3 1 1 0 16 1 1 4	1 1 19	0 3	2 90	1	3 3 0
2	0 7 4	1 1 1 8	2   1   1   1   1   1   1   1   1   1	4 37 8 1 0 2	2 9 4 2 9 8	2	3 3 4 3 8
6	0 7 8	2 1 20	27 1 16	0 2	2 10 0	3 48	3 40
1	0 8 4	3 1 2 4	1 1 16	5 4 3	2 10 4	1	3 3 8 3 4 0 3 4 4
2	0 8 4	3 I 2 4 17 I 2 8	1   1   1   1   1   1   1   1   1   1	3 8 8 38 7 0	2 10 4 2 10 8 2 11 0	2	3 4 4 3 4 8
3	0 90	1 1 30	3 1 17	0 1	2 11 0	3	3 50
7	0 9 4	2 1 3 4 3 1 3 8	28 1 17	4 2		49	3 5 4
i	0 98	3 1 38	1 1 17	4 2 8 3 8 0 39	2 11 4 2 11 8	1	3 5 4 3 5 8
2	0 10 0	2 1 2 0 3 1 2 4 17 1 2 8 1 1 3 0 2 1 3 4 3 1 3 8 18 1 4 0 1 1 4 4 2 1 4 8 3 1 5 0 19 1 5 4 1 1 5 8 2 1 6 0 3 1 6 4 20 1 6 8	3 1 12 26 1 14 1 1 13 2 1 16 3 1 17 2 1 16 3 1 17 2 1 18 3 1 18 2 1 18 2 1 18 3	0 39	2 11 4 2 11 8 2 12 0 2 12 4 2 12 8 2 13 0 2 13 4 2 13 8 2 14 0	2	3 4 8 3 5 0 3 5 4 3 6 8 3 6 0 3 6 8 3 7 0 3 7 4 3 7 8 3 8 0
3	0 10 4	I I 4 4 2 I 4 8	3 I 18 29 I 18 1 I I	8 4 1 8 8 2 0 3	2 12 4	50	3 6 4 3 6 8
8		2 1 48	29 1 18	8 8 2	2 12 4 2 12 8 2 13 0		3 6 8
1	0 11 0	3 1 50	3 I 18 29 I 18 1 I 10 2 I 10 3 I 10	0 3	2 13 0	1	3 70
2	0 11 4	19 1 5 4 1 1 5 8	3 1 10	8 40	2 13 4	2	3 7 4 3 7 8
3		2 1 6 0	3 1 10	8 1	2 13 8	-3	3 7 8
9		3 1 6 4			2 14 0	51	3 80
2	0 12 4	3 1 6 4 20 1 6 8	2 2 0	8 41	2 14 4 2 14 8	2	3 8 4 8 8
3		1 1 70	3 2 1	0 1	2 15 0	3	3 90
10	0 13 4	2 1 74	31 2	4 2	2 15 4	52	3 9 4
1	0 13 0 0 13 4 0 13 8	3 1 78	3 2 1 31 2 1 1 2 1 2 2 2	8 3	2 12 0 2 12 4 2 12 8 2 13 0 2 13 4 2 13 8 2 14 0 2 14 4 2 14 8 2 15 0 2 15 4 2 16 0	3~	3 1 4 3 1 8 3 2 0 3 2 4 3 3 2 8 3 3 4 3 3 8 3 4 4 3 3 5 4 3 3 6 6 4 3 3 6 6 8 3 7 7 8 3 8 8 8 8 3 3 9 9 4 3 3 9 9 8 3 10 0
1 2	0 14 0	21 1 80	2 2	0 42	2 16 0	2	3 9 4 3 9 8 3 10 0
-			1 2 3			-4	

TABLE II. continued.

In	7 7 1	n	-	BLE	11. con	1110	L. C. Santa A.	71	n	1 1
Bar. I	. s. d.	Bar.	1. s. d.	Bar	. l. s.	$d. \  Ba$	r.l.	s. d.		1. s. d.
3 3	10 4	3	4 6 4 4 6 8	3	5 2	4 1 3	:5	18 4	3 1	6 14 4
53 3	108	65	4 68	177	5 2	8 8 8 8	5	18 4	IOI	6 14 8
1 3	11 0	1	4 70	1	5 3	0 1		190	1 1	6 15 0
2 3		2	4 7 4	2	5 3	4 2		194		6 15 4
3 3		3	4 7 8	3	5 3	8 1 3	5	198		6 15 8
54 3	12 0	66		78		0   90		00		5 16 0
1 3	12 4	1	4 8 4 4 8 8	1	5 4	4   1	6	0 4 0 8	1 0	5 16 4
2 3		2		2	5 4	8 2	16		2 6	
3 3	130	3	4 90	3	5 5	0 3	6	10	3 6	
55 3	13 4	67	4 9 4	79	5 5	91	6	1 4	103 6	17.4
1 3	1.3 8	1	4 9 8 4 10 0	1	5 5		16	18	1 6	
3 3	140	2	4 10 0	2	5 5 5 5 5 6 5 6	2	6	20	2 6	
1 . 1 . 1	14 4	68	4 10 4	3	5 6	3 92	6	2 4 2 8	3 6	18 4
		1		80		92	6		104 6	
2 3	15 0 15 4 15 8 16 0	2	4 11 0	2		1 2		3 0	2 6	
3 3	15 8	3	4 11 4 4 11 8	3	5 7 4	2 3	6	3 4 3 8 4 0	3 6	
57 3	160	69	4 12 0	81	5 7 8		6	40		
1 3	- 1	I	4 12 4	1	5 8					The state of the s
2 3	16 4	2	4 12 8	2	5 8 2 5 8 8	2	6	4 4 4 8	1	
3 3	170	1	4 13.0	3	5 9 0		6	4 4 8 5 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	3 7	10
58 3	17 4	70	4 13 4	82	5 9 4	94	6.	5 4	106 7	
1 3	17 8		4 13 8	1	5 9 4	1	16	5 4	1 7	
2 3	17 8		4 14 0	2	5 10 C		6	60	2 7	
3 3	18 4		4 14 4	3	5 10 4		6	6 4	3 7	24
59 3			4 14 8	83	5 10 8	95	6	6 4	107 7	2 4
1 3	190	1	4 15 0	1	5 11 0	11	6	70		
1 2 3	19 4	2	4 15 4	2	5 11 4	. 2	6	7 4 7 8 8 8 9 8 9 8 9 8 9 8 9 8 9 8 9 9 9 9	1 7 2 7 3 7	3 0 3 4 3 8 4 0
3 3	198		4 15 8	3	5 11 8	3	6	7 8	3 7	3 8
60 4	0.0			84	5 12 0	96	6 8	30	08 7	40
1 4	0 4		4 16 4	1	5 12 4		6 8	8 4 8	1 7	4 4 4 4 8
2 4			4 16 8	2	5 12 8		6 8	3 8	2 7	48
61 4	10		4 17 0	3	5 13 0		6	0	3 17	50
	I 4 I 8		4 17 4	.85	5 13 4 5 13 8	97	0	4 11	09 7	4 4 8 5 6 5 4 5 6 6 4 8 6 8
1 4 4 4	1 8		4 17 8	1	5 13 8	1	6	8	2 7	5 8
3 4				2	5 14 0	2	6 10	0		60
62 4	2 4 2 8		4 18 4	86	5 14 4 5 14 8	98	6 10	8	3 17	6 4 6 8
1 4				1	5 14 8	90	6 11		10.7	0 8
2 4	3 4		4 19 0	2	5 15 0	1 2	6 11		1 7	70
3 4	3 8		4 19 4	3	5 15 0 5 15 4 5 15 8	3	6 11	- 11	2 7 7 7	7 4 7 8
63 4	40		5 00	87		99	6 12		117	80
1 4			0 4	1	5 16 4	199	6 12	4	SUBSTITUTE AND S	
2 4	4 4 4 4 8	2 4	0 8	2	5 16 8	1 2	6 12	- 11	2 17	8 4 8 8
3 4	50	3 4	10		5 17 0	1 3	6 13	0	1 7 7 7 3 7	
64 4	5 4			88	5 17 4	100	6 13		12.7	90
1 4	5 0 5 4 5 8 6 0	76 5	1 4		5 17 8	1	6 13	0 11	1	' '
2 4	6011	2 15	20	2	5 17 8	2	6 14	0	1	

## Ch.XVIII. C. Brewers in Co. at 5 s. per Barr. 101

TABLE III.
See it explained on Page 108.

Cash Tables for the Excise on Strong BEER and ALE for the Use of Common Brewers in the COUNTRY, at 5 s. per Barrel, with their Allowance \* of Two Barrels and an half in every 23, being deducted out of the said 5 s.

Bar.	1.	1 5.	d.	9	Pt	Bar.	1 1.	5.	d	19	PI
1	0	1	1	1	11	120	26	14	9	1	12
1	0	2		2	22	130	28	19	4	0	13
3	0	3	4	0	10	140			10	3	19
1 4 1 2 3 4 1	0	1	-	I	21	150	22	8		2	22
2	0	8	5	3	19	160	35	13	5	2	
	0	13		I	17		31 33 35 37	17	7	1	5 8
3 4	0	13	9 3 8	3	15	170	40	2	7 2 8 3 10	0	8
5		2	3	I	15 13 11	190	42	6	8		11
5	1	6	8	3	11	200	44	11	3	3 2	14
7	1	11	2	I		210	44 46	15	10	1	17
7 8	1	15	7	3	7	220	49	0	5	0	20
9	2	15	1	I	5	230	51	5	0	0	0
10	2	4	6	3	9 .7 5 3 1	240	49 51 53 55 57 60	9	6	3	
11	2	9	0	I	I	250	55	14	1	2	36
12	2	13	-5	2	22	250	57	14	8	1	9
13	2	13	11	0	20	270	60		3	0	9
14	3	2	4	2	18	270 280	62	3 7	9	3	15
15	3	6	10	0	16	290	64	12	4	2	15
16	3	11	3	2	14	300	66	16	II	1	21
17	3	15	-9	0	12	310	69	1	6	I	1
18	4	0	2	2	10	310 320 330 340 350 360	71	6	I	0	4
19	4	4	8	0	8	330	73	10	7	3	7
20	4	9 13 18	1	2	6	340	75	15	2	2	10
21	4	13	7 0	0	4	350	77	19	9	1	13
22	4	18	0	2	2	360	80	4 8	4	0	16
23	3 4 4 4 4 5 6	2	8	0	0	370 380	82		10	3	19
30	6	13	8	I	9	380	84	13	.5	2	22
40	8		3	0	12	390	86		0	2	2
50 60	11	2	9	3	15	400	89	2	7	I	5 8
60	13	7-	4	2		410	91	7	2	0	
70 80	15	11	II	1	21	420	93	11	8	3	11
80	17	16	6	1	1	430	95	16	3	2	14
90	20	1	I	0	4	440	98	0	10	1	17
100	22	5	7 2	3	7	450	IOC	5	5	0	20
110	24	101	- 2	2	10	460	102	10	0	0	0

<sup>\*</sup> The Acts of Parliament relating to the respective Duties and Allowances on Strong Beer and Ale, and Small Beer, are 12 Car. II. 1, 4, 5 of Will. & M, and the 4 & 3 Anns.

# 102 C. Bzewers in Co.at 18. 4d. per Bar. Part II.

# TABLE IV. See it explained on Page 108.

Cash Tables for the Excise on Small BEER for the Use of Common Brewers in the Country, at Ts. 4 d. per Barrel, with their Allowance of Two Barrels and an half in every 23. being deducted out of the said 1 s. 4 d.

Bar.	11.	5.	d.	9	Pt	II Bar.	1.	5.2	d.	9	Pt
	1_	1	-	A	-	Dar.	1	3			-
Ī	0	0	1 2	2	6	110	. 6	10	8	2	18
14134	0	0	7	0	12	120	17.	2		I	5
1 . 3	0	0	10	2	18	130		14	-	3	15
1	0	I	2	I	ı	140	7 8	6	. 3	2	2
2	0	2		2	2	150	. 8	18	2	0	12
	0		6	3		160	9	10	7 5 4 3	2	22
3 4 5 6	0	3 4 5 7 8	9	0	3 4 5 6	170	10	2	0	1	
1 7	0	1 5	11	1	1 7	170	10	12	10		9 19 6 16
6	0	7	1	2	16	190	II	- 5	0	3 2	6
	0	8		3	7	200	11	5	9.	0	16
7 8	0		6	0	7 8	210	12	9	6.	3	3
9	0	9	8	I	9	220	13	I	5	I	3 13 0
9	0	11	10	2	9	230	13		5 4	0	0
111	0	13	0	3	11	240	14	13 5 17 8	2	2	10
12	0	14		0	12	250	14	17	1	0	20
	0	15	5 7	I	13	260	15	8	11:	3	7
14	0	15	7	2	14	270	15	0	10	1	17
13 14 15 16	0	17	9	3	15	280	16	12	9	0	4 14
16	0	19		0	15	290	17	4	9 7 6	2	14
17	1	Ó	2	1	17	300	17	16	6	1	- 1
17	1	1	6	2	17	310	17	8	4	3	11
19	1	2	6	3	19	320	19	0	4 3		21
20	1	3	9	0	20	330	19	12		0	8 18
21	1	3 4 6	II	I	21	340	20	4	0	2	18
22	1	6	1	2	22	350	20	15	11	1	.5
23	1	7	4	0	0	350 360	21	7	9	3	15
30	I	15	4 7 6	3	7	1 370	21	19	9		. 2
40	2	7			17	380	22	11	7	0:	12
50	2	7 15 7 19	5	0	4	390	23	3	5	2	22
40 50 60	3	11	5	2	14	400	23	15	7 5 4 2	1	9
70 80	4	3	2	1	1	410	24	7 19 11	2	3	19
80	4	15	0	3	II	420	24	19	I.	3	. 6
90	4 4 5 5	6		I	21	430	25 26		O	0	16
100	51	18	10	ol	8	440	26	2	10	31	. 3

# Ch.XVIII. E.Bzew. in Lond. at s s. per Bart. 103

### TABLE V.

Sed it explained on Page 109.

Cash Tables for the Excise on Strong BEER for the Use of Common Brewers in London, or the Bills of Mortality, at 5 s. per Barrel, with the r Allowance of 3 Barrels in every 23. being deducted out of the said 5 s.

			10	. 34	1		The Way	1		4		4		1
	B.	1	5. a	t.	7. 2:	Ba	.   1.	Bar	11.	Bar	. 1 1.	Bar.	1.1	1
T	L	0	î:	ï	:oi : 4	46	10	73	6 160	1420	310	211	6 460	
1	I	0	2 2	2					1			11		
	141/23/4	0	3:	2050	0 12		1	11				11		
	1.				0 16		1	809				1		
1	2		8	1	1 . 9	1		11 0 0			1	11		I
	3				2 : 2			851				11		
	4	0 1			2.18						340			
	5				3 11			897	195					I
-	2			1			1	920						Ì
1	5	1	6	1 (		1 73	55	943	1	1633		2323		ı
1:		1 1		5 6			60	966		1656	360	2346		١
1 8	3	1 12		9 1		299	65	989		1679	365	2369	515	ı
19	1	1 10		1 2			70	1012	220	1702	370	2392		
110		2		5 2		345	75	1035	225	1725	375	2415		ı
-						368	80	1058	230	1748	380	2438	530	ı
111	1	2 7	, (	9 3	15	391	85	1081	235	1771	385	2461	535	
112						4 4	90	1104	240	1794	390	2484	540	
13		7.1			1	437	95	1127	245	1817	395	2507	545	
14					17	460	100	1150	250	1840	400	2530	550	
					10	483	105	1173	255	1863	405	5060	1100	
15	13	9				506	110	1196	260	1886	410	7590	1650	
1-	1-					529	115	1219	265	1909	415	10120	2200	
17	13	13	10	3	19	552	120	1242	270	1932	420	12650	2750	
18	3	18	3	0	12	575	125	1265	275	1955	425	15180	3300	
19	4	2	7	1	5	598	130	1288	280	1978	430	17710	3850	
20	4	6	11	I	21	621	135	1311	285	2001	435	20240		
21	4	11	3	2	14	644	140	1334	290	2024	440			
22	4	15	7	3	7	667	145	1357	295		445	25300	5500	
23	5	ó	ó	0	0	1	150	1380	300				6050	
							155		305!		455			
	_												-	

### 104 C. Bzewers in London at 5 s. Ale. Part II.

TABLE VI.
See it explained on Page 109.

Cash Tables for the Excise on Ale for the Use of Common Brewers in London, at 5 s. per Barrel, with their Allowance of 2 Barrels in every 22. being deducted out of the said 5 s. by C. Leadbetter.

IB	· ] L. s.	d. q. 22	Ba.	1.	Bar.	1 %	Bar.	1 1.	Bar.	1 1.
1	0 1	I 2 12	1 44	10	704	160	1364	310	2024	460
	0 2	3 I 2	66	15	726			315	2046	465
1	0 3	4 3 14	11	20	748			1320	2068	470
1	0 4	62 4	110	25	7.70		1430	325	2090	
1 2		108	132	30	792			330	2112	
3		7 2 12	154	35	814		1474	335	2134	
1 4	0 18	2016	176	40	836		1496	340	2156	
1 4	1 2	8 2 20	198	45	858	195		345	2178	
1-			220	50	880	200	1540	350		
1 6	1 7	3 1 2	242	55	902	205	1562	355	2222	
8		93 6	264	60	924	210	1584	360	2244	
8	1 16	4 1 10	286	65	946	215	1606	365	2266	515
9	2 0	10 3 14	308	70	968	220	1628	370		520
10		5 1 18	330	75	990	225	1650	375	2310	525
1			352	80	1012	230	1672	380	2332	530
11	2 10	00 0	374	85	1034	235	1694	385	2354	535
12	2 14	62 4	396	90	1056	240	1716	390,	2376	540
13	2 19	108	418	95	1078	245	1738	395	2398	545
14	3 3 8	7 2 12	440	100	1100	250	1760	400	2420	550
15		2016	462	105	1122	255	1782	405	4840	1150
16	3 12	8 2 20	484	110	1144	260	1804	410	7260	1650
1-			506	115	1166	265	1826	415	9680	2200
17	3 17	3 1 2	528	120	1188	270	1848	420	12100	2750
18	4 I.	93 6	550	125	1210	275	1870	425	14520	3300
19	4 6	4 1 10	572		1232	280	1892	430	16940	3850
20	4 10 1	10 3 14			1254	285		435	19360	4400
21	4 15	5 1 18	616	140	1276	290		440	21780	4950
22	5 0	00 0				295	1958	445	24200	5500
					1320	300		450	26620	6050
1		1	682	155	1342	305	2002	455 1		
-										

### Ch.XVIII. C. Bzewers in Lond. at 18. 4d. per Bar. 105

TABLE VII.
See it explained on Page 109.

Cash Tables for the Excise of Small Beer, for the Use of Common Brewers in London, at 1s. 4d. per Barrel, with their Allowance of 3 Barrels in every 23, being deducted out of the said 1s. 4d. by C. Leadbetter.

I DU	Tau -								
B.7.	s. d. q. 23	Bar.	1. s. d.	Bar.	1. s. d.				
1 0	0 3 1 21	483	28 00	1633	94 13 4				
10		506	29 68	1656	96 00				
4 1 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0	3 - 3	529	30 13 4	1679	97 68				
10	1 13 15	552	32 00	1702	98 13 4				
20	2 3 3 7	575	33 68	1725	100 0 0				
30	3 52 22	598	34 13 4	1748	101 68				
40	4. 72 14	621	36 00	1771	102 13 4				
50		644	37 68	1794	104 0 0				
50	6 11 1 21	667	36 13 4	1817	105 6 8				
70	8 11 13	690	40 00	1840					
80	9 3 1 5	713	41 6 8	1886	108 0 0				
90			44 00	1909	110 13 4				
100	11 70 12	759 782	45 68	1932	112 00				
IIO		805	46 13 4	1950	113 68				
120		828	48 00	1978	114 13 4				
	15 03 11	851	49 68	2001	116 00				
1 1	16 23 3	874	50 13 4	2024	117 68				
	17 40 16	897	52 00	2047	118 13 4				
17 1	19 82 2	920	53 68	2070	120 0 0				
181	0 10 1 17	943	54 13 4	2093	121 68				
191	2 01 9	966	56 00	2116	122 13 4				
20 I	3 2 1 1	989	57 68	2139	124 00				
211	4 40 6	1012	58 13 4	2162	125 6 8				
22 1	5 60 8	1035	60 00	2185	126 13 4				
23 1	6 80 0	1058		2208	128 00				
		1104	64 00	2231	130 13 4				
		1127	65 68	2277	132 00				
Bar.	1 1. s. d.	1150	66 13 4	2300	133 68				
		1173	68 00	2323	134 13 4				
46	2 13 4	1296	69 68	2346	136 00				
69	4 0 0	1219	70 13 4	2369	137 68				
92	5 6 8	1242	72 00	2392	138 13.4				
115		1265	73 68	2415	140 0 0				
138	8 00	1288	74 13 4	2438	141 68				
161	9 6 8	1311	76 00	2461	142 13 4				
184	10 13 4	1334	77 68	2484	144 0 0				
207	12 0 0	1357	78 13 4	2507	145 6 8				
230	13 6 8	1380	80 00	2530	146 13 4				
253	14 13 4	1403	82 13 4	5060	293 6 8				
276	17 6 8	1426	84 0.0	7590	586 13 4				
322	18 13 4	1472	85 68	12650	733 6 8				
345	20 0 0	1495	86 13 4	15180	880 00				
368	21 6 8	1518	88 00	17710	1026 13 4				
391	22 13 4	1541	89 68	20240	1173 68				
414	24 0 0	1564	90 13 4	22770	1320 00				
437	25 6 8	1587	92 00	25300	1466 13 4				
460	26 13 4	1610	93 68 1	27830	1613 68				
-					'				

#### Tiale VIII.

See it explained on Page 109.

Cast Tables at 6 d. per Bussel, 1. also Duty on MALT IN the Ciftern, or when it has been ob. of a see than 30 Hours \*: The Allowance to be made the Masster at that Time of 4 Bushel in every 20, being deducted out of the said 6 d.

Buth.	15	9	₽ 5	Buh 1. s.
1 0	s. d. q. pts	2 1. 3. d. q.pts	3 1. s. d. g.pts	1. P 1. s.
1	0 4 3, 1 3		67 1 6 9 2 2	
1 2	0 9 2 3 3	0 14 0 0 0	68 1 7 2 1 3	1 NO 2 4
1 3	1 2 1 3 36	0 14 4 3 1	69 1 7704	
4	170437	0 14 9 2 2	70 1 8 0 0 0	
5		0 15 2 1 3	71 1 8 4 3 1	140 2 16
		0 15 7 0 4	72 1 8 9 2 2	150 3 0
8	292240	00001	73 1 9 2 1 3	
		0 16 4 3 1	74 1 9 7 0 4	170 3 8
9	3704 42	0 16 9 2 2	75 1 10 0 0 0	170 3 8
10	4000 43	0 17 2 1 3	76 1 10 4 3 1	190, 3 16
11	4 4 3 1 44	0 17 7 0 4	77 1 10 9 2 2	200 - 4 0
12	492245	0 18 0 0 0	78 1 11 2 1 3	210 4 4
13	5 2 1 3 46	0 18 4 3 1	79 1 11 7 0 4	220 4 8
14	5704 47	0 18 9 2 2	80 1 12 0 0 0	230 4 12
15	6000 48	0 19 2 1 3	81 1 12 4 3 1,	240 4 16
16	6 4 3 1 49	0 19 7 0 4	82 1 12 9 2 2	250 - 5 0
17	692250	1 0000	83 1 13 2 1 3	300 6 0
18	7 2 1 3 51	1 0 4 3 1	84 1 13 7 0 4	400 8 0
19	7704 52	1 0922	85 1 14 0 0 0	500 10 0
. 20	8000 53	1 1 2 1 3	86 1 14 4 3 1	600 12 0
21	8 4 3 1 54	1 1704	87 1 14 9 2 2	700 14 0
22	8 9 2 2 55	1 2000	88 1 15 2 1 3	800 16 0
23	921356	1 2 4 3 1	89 1 15 7 0 4	900, 18 0
24	970457	1 2922	90 1 16 0 0 0	1000 20 0
25	10000 58		91 1 16 4 3 1	2000 40 0
26	10 4 3 1 59		92 1 16 9 2 2	3000 60 0
27	10 9 2 2 60		93 1 17. 2 1 3	4000 80 0
28	11 2 1 3 61	THE RESERVE OF THE PARTY OF THE	94 1:17 7 0 4	5000 100 0
29	11704 62		95 1-18 0 0 0	6000 120 0
30	1200063	1 5 2 1 3	96 1 18 4 3 1	7000 140 0
31		1 57040	7 1 18 9 2 2	8000 160 . 0
32	1292 2 65	1 60000	98 1 19 2 1 3	9000 180 + 0
33	13 2 1 3 66			0000 200 0

# TABLE IX. See, it explained on Page 109.

Galb Tables at 6-d.-per Bushel for the Duty on Malr, when it has been OUT OF the Cistern, 30 Hours or more\*: The Allowance to be made the Master at that Time of 10 Bushel in every 20, being deducted out of the said 6 d.

N° of Bush.     s. d.     E     s. d.     I     s. d.     s. d.     s. d.     I     s. d.     s. d. <th>5 0 7 6 0 0</th>	5 0 7 6 0 0
1 0 3 34 8 6 67 0 16 9 100 1	7 6
2 10 6 2 2 8 0 68 0 17 0 110 1	7 6
2 100 135 0 9 00 0 1/0 110 1	0 0
3 0 9 36 9 0 69 0 17 3 120 1 1 4 1 0 37 9 3 70 0 17 6 130 1 1	- 61
4     1     0     37     9     3     70     0     17     6     130     1     1       5     1     3     38     9     6     71     0     17     9     140     1     1     1       6     1     6     39     9     9     72     0     18     0     150     1     1       7     1     9     40     10     0     73     0     18     3     160     2	
5 1 3 38 9 6 71 0 17 9 140 1 1 6 1 6 39 9 9 72 0 18 0 150 1 1	50
6 16 39 99 72 0 18 0 150 1 1	7 6
7 1 9 40 10 0 73 0 18 3 160 2 8 2 0 41 10 3 74 0 18 6 170 2 9 2 3 42 10 6 75 0 18 9 180 2 10 2 6 43 10 9 76 0 19 0 190 2	2 6
18 2 0 41 10 3 74 0 18 6 170 2	2 6
9 2 3 42 10 6 75 0 18 9 180 2	6
11. 29 44 11 0 77 0 19 3 200 2 10	0
12 3 0 45 11 3 78 0 19 6 210 2 13	
12 3 0 45 11 3 78 0 19 6 210 2 13 13 3 3 46 11 6 79 0 19 9 220 2 13 14 3 6 47 11 9 80 1 0 0 230 2 13	
14 3 6 47 11 9 80 1 0 0 230 2 17	
15 3 9 48 12 0 81 1 0 3 240 3 0 16 4 0 49 12 3 82 1 0 6 250 3	
16     4 0     49     12 3     82 1 0 6     250     3 2       17     4 3     50     12 6     83 1 0 9     300     3 15       18     4 6     51     12 9     84 1 1 0     400     5 6       19     4 9     52 13 0     85 1 1 3     500     6 3       20     5 0     53 13 3     86 1 1 6     600     7 10	
17 4 3 50 12 6 83 1 0 9 300 3 15 18 4 6 51 12 9 84 1 1 0 400 5	0
18 4 6 51 12 9 84 1 1 0 400 5	0
18 4 6 51 12 9 84 1 1 0 400 5 0 19 4 9 52 13 0 85 1 1 3 500 6 9 20 5 0 53 13 3 86 1 1 6 600 7 10	0
20 5 0 53 13 3 86 1 1 6 600 7 10 21 5 3 54 13 6 87 1 1 9 700 8 15	0
21 5 3 54 13 6 87 1 1 9 700 8 15 22 5 6 55 13 9 88 1 2 0 800 10 0	0
22   5 6   55   13 9   88   1 2 0   800   10 0 23   5 9   56   14 0   89   1 2 3   900   11 5	0
23 5 9 56 14 0 89 1 2 3 900 11 5 24 6 0 57 14 3 90 1 2 6 1000 12 10	0
24 6 0 57 14 3 90 1 2 6 1000 12 10 25 6 3 58 14 6 91 1 2 9 2000 25 0	
25 6 3 58 14 6 91 1 2 9 2000 25 0 26 6 6 59 14 9 92 1 3 0 3000 37 10	
26   66   59   14 9   92   1 3 0   3000   37 10	0
27   6 9   60   15 0   93   1   3 3   4000   50 0 0 28   7 0   61   15 3   94   1   3 6   5000   62 10	0
28   7 0   61   15 3   94   1 3 6   5000   62   10 29   7 3   62   15 6   95   1 3 9   6000   75   0	0
27 6 9 60 15 0 93 1 3 3 4000 50 0 28 7 0 61 15 3 94 1 3 6 5000 62 10 29 7 3 62 15 6 95 1 3 9 6000 75 0 30 7 6 63 15 9 96 1 4 0 7000 87 10	0
30 7 6 62 15 0 06 1 4 0 7000 87 10	0
31 7 9 64 16 0 97 1 4 3 8000 100 0 32 8 0 65 16 3 98 1 4 6 9000 112 10	0
29	0
31	0

See Page 150, Part I.

## The EXPLANATION and Use of the preceding TABLES.

The foregoing Tables are not only very useful to Officers in making up their Accompts against the Sittings, but to those Traders who are subject to the respective Duties.

Of TABLES I and II. on Pages 97, 98, 99, and 100. For Victuallers.

Both these Tables begin with a Quarter of a Barrel, (viz. a Firkin) and end with 112 Barrels.

N. B. The large Figures in the Columns titled Bar. fignify fo many Barrels; and the fmall Figures between them, Quarters of Barrels.

Example. I demand how much Excise a Vistualler has to pay for 46 \(\frac{1}{4}\) Barrels of Ale, and 29 \(\frac{3}{4}\) Barrels of Small Beer?

Look in Table I. for  $46\frac{1}{4}$  Barrels, and against it you have

Look in Table II. for  $29\frac{3}{4}$ , and against it

you have

And thus you find the Excise or Duty amounts

13 10 11

N. B. If your Number of Barrels be more than 112, you must take it out of the Table at twice.

Of TABLES III. and IV. on Pages 101 and 102. For Common Brewers in the COUNTRY.

Both these Tables begin with \(\frac{1}{4}\) of a Barrel, (or Firkin) and end with 460 Barrels.

Example. What Excise has a common Brewer in the Country to pay for 50 ½ Barrels of Small Beer? 1. s. d. q. pts. and against it is the Duty

2dly, Look at the Beginning of the Table in the same Column for ½ Barrel, against it is

And thus you have found that the Duty
of 50½ Barrels of Small Beer is

300016

N. B. If your Number of Barrels exceed 460, you must take it at twice out of the Table.

y

f

Of TABLES V. VI. and VII. on Pages 103, 104, and 105. For Common Brewers in London.

Example. What Excise is to be paid for 430 Barrels of Strong Beer by a common Brewer in London?

430. The Number given is not to be found in the Table, therefore I take the next less 1. s. d. pts.

Number, which is—414—which comes to 90 0 0 00

To make up 430.—16—3 9 6 33

N. B. The Use of Tables VI and VII. being the very same, they need no Examples.

Of TABLES VIII and IX. on Pages 108 and 109.

For MALSTERS.

Example. A Malster is charged with 381 Bushels from Cistern and Couch, and 94 Bushels from the Floor; I demand how much Neat Duty he is to pay for it?

Total 8 15 9 3

And thus you have found that 8 l. 15 s. 9 d.  $\frac{3}{4}q$  is the neat Duty or Excise to be paid for 381 Bushels of Malt from the Cistern and Couch, and 94 Bushels from the Floor.

N.B. The Fractional Parts of a Farthing in these Tables are never regarded, unless they amount to balf a Farthing.

F

Af

Ge

### CHAP. XIX.

A List of the Commissioners of his Majesty's Royal Revenue of Excise, &c. in England, and other Officers employ'd therein, with their respective Salaries.

Note, The Offices and Salaries in the following List are always the same, but the Officers by Death and Removals are frequently changing.



INE Commissioners of Excise, each 1000 !. } 9000 0 0

Charles Polhith, Efq; Horatio Townshend, Efq; John Fowle, Efq; Sir Thomas Robinson, Bt.
Thomas Wylde, Efq; William Burton, Efq; James Vernon, Efq; Orlebar, Efq; Robert Eyre, Efq;

Five Commissioners of Appeals, each	200 l. per Ann.	1000	0	0
Humphry Forule, Esq; John	Paul Yvonnet, Efq;			
Humphry Fowle, Esq; John James Montague, Esq; Edwy	n Coney, Esq;	140	1 0	15
Sir Moor Molyneux, Knt.		17.4.80		
Secretary to the Commissioners of				
Excise 540 l. per Annum.	Bendal Martin, Esq;-	540	0	0
His first Clerk, 100 l. per Ann.	Arthur Sheppard, Efq;	100	0	0
His second Clerk, 501. per Ann.	Philip Parsons,	50	0	0
Solicitor to the Commissioners of Exci				
Efq; for himself and Clerk, viz.	William Hazard.	610	0	0
D : 0 : C				
cife, 350 l. per Ann.	John Blois, Esq;	350	0	0
Two Clerks to Ditto, each 80 1. per	Thomas Whitaker		196	
Ann.	Henry Edmons,	160	0	.0.
Register to the Commissioners of Ap-				
peals, 100 l. per Ann.	Thomas Hawes, Efq;—	100	0	0
Messenger, and Door-keeper, each	Foleth Wincles			11
	0 117 1	80	0	0
Correspondent to the Commissioners				
Correspondent to the Commissioners of Excise, 220 l. per Ann.	William Pinney, Efq;	220	.0	0
His first Clerk 65 l. per Ann.	Robert Simon			
His fecond Clerk 56 l. per Ann.	Thomas Steerenson	121	0	0
Clerk to the Securities 200 l. per Ann.		200	0	0
Che of mal den de	John Adlam, Esq;	200		
Three Affiftants the 1st 70 l. per An.	Philip Brewfter, Efq;		•	•
to Ditto 20 and 3d, 301.	S.L. William	170		0
each	John Williams	-		

Carried forward 12701 0 0

Chap.XIX. Excise List.		11	I.
	1.	5.	d.
Brought forward	12701	0	0
Clerk'of the Diaries 801. per Ann. John Rocket	80		0
Affiftant to Ditto, 50 l. per Ann. Daniel Davies		0	
Store-keeper, 100 l. per Ann. Henry Buck	100		
Store-Reeper, 1001. per Ann. Henry Dack	.00		-
Clerks to Ditto { 1st at 70 l. per Ann. Charles Garnier } }	110	0	0
Packer in the Store-keeper's Office \ Joseph Salmon	50	0	0
General-Accomptant of Excise 2001. Henry Needler	200	0	0
Clerk for entering the Bills of Ex- Samuel Underwood change, 100 l. per Ann.	100	0	0
Accomptant for the London Diftil- Robert Mathews	150	0	0
lery, 150 l. per Ann. Affiltant to Ditto, 50 l. per Ann. Francis Marshall	50	0	0
Two Accomptants for the London and at 120 l. p. An. William Pollard at 80 l. p. An. Henry Forrester	200	0	0
Two, as Excise			
Accomptants, and for the And the Analysis of t	100	0	0
bution.			
Four Accomptants for Excise, each William Crawford 80 l. per Ann. and Thomas Mit- Edward Tyler	340	0	0
chel, 20 l. per Ann. for Civil List John Garver Tax on Sallaries, at 6 d. per 1. Thomas Mitchell			
Malt and Dops.			
General-Accomptant for the faid Valent Comen	200	0	0
Accomptant for Malt, 80 l. per Ann. John Wardour	80	0	0
Four Affistant-Accomptants for Malt Robert Grey	-0-		
each 70 l. per Ann. Thomas Longsbeth Grof. Bedford	280	٠	٥
Accomptant for Hops, 70 l. per Ann. George Williams Affishant to the Excise and Malt	70	0	•
General-Accomptants, 50 l. per Brook Luce	50	•	0
Dew Duties.	Fort		
General-Accomptant for the Duties on Candles, Soap, Pa- per, Callicoes, Gold and Silver Wire, and Starth, 2001.	200	•	0
Carried over	15111	0	0

)

0 0 0

112 Ercise List.			Part II.			
		1.		d.		
	Brought over	15111				
Two Accomptants						
for Candles in Ist at ool, p.	Ann. Thomas Radeliffe 7					
Town and Country, and for the 2d at 201. p.	Ann.	110	0	0		
try, and for the						
Bank of Charity	. )					
Affiltant-Accomptant for Candles in Town, 70 l. per Ann.	Stephen Penny	70	0	0		
Ditto for Soap, Paper, Callicoes,		,-				
Wire, and Starch, in Town, 70	1. Peter Bezard		_			
per Ann.		70	0	0		
Ditto for Country Callicoes, Wire,	TEL WILL					
and Starch, 70 l. per Ann.	S Euroura Wiljon	70	0	0		
Ditto for Country Soap, 701. per A	nn. Richard Clarke	70	0	0		
Ditto for Country Paper, 501. per A	Inn. Stilling fleet Durnford	50	0	0		
Clerk of the Entries for the fair	d)					
Duties, and for Silver Plate	Peter Fenhoulet	65	0	0		
Wrought, 65 l. per Ann.	)					
Mines Allata Matter	Tee and The					
Pides, Plate, Coffee,						
colate.						
General-Accomptant for the faid Duties, 200 l. per Ann. Six Affiftant-Accomptants for Dut Vellom and Parchment, Silver Coffee, Tea, and Chocolate, Tow	y on Hides and Skins, Plate Wrought in Town,	200	•	0		
[ ift, 80 l. per Ann.	(John Johnson					
2d, 70 l. per Ann.	Stephen Barbier					
] 3d, )	Thomas Young					
14th, ( and the day each	Robert Ronell	350	0	0		
5th, 501. per Ann. each	Goulston Bruere					
(oth,)	Edward Lens					
Comptroller of Excise, &c. for him-	70					
felf, exclusive of his Clerks,	Sir Edm. El-well, Bart.	775	0 0	1		
775 l. per Ann.	) W:11: C 1					
His Deputy	William Stanley					
For Entering Bills of Exchange, &c. 120 l. per Ann.	John Bruere	120	0 0			
On Excise, 100 l. per Ann.	Forrester Ford					
	( Daniel Monty )	100	0 0			
Three on Excise, each 80 l. per Ann.	Edward Parlons	240	0 0			
	Richard Parsons	240	0.0			
Two on Malt, each 60 l. per Ann.	Brudenell Greenwood					
and di man, cach oo s. per Ann.	John Southey	120	0 0	1		
		•				
	Carried forward 1	7521	0			

Chap. XIX.	e List.		11		
			1.	5.	d.
		Brought forward	17521	0	0
On Candles and Victualles 65 l. per Ann.	rs in Town	Thomas Turner	65		0
On Hops and Candles in the	e Country,	John Sydenham	60	0	0
Three for Soap, Paper, Wire, and Starch, To Country, each 60 l. per	wn and Ann.	Abraham Cock Charles Bromfield Thomas Cooper	180	0	•
Two for Hides and Skins and Parchment, in To Country, each 60 l. per	wan and	Nicolas Penfound Giles Keith	120	•	0
For Coffee and Tea, 50 1.		Stephen Sanderson	50	0	0
For Chocolate, 50 1. per	Ann.	Thomas Hope	50	0	0
For Silver Plate Wrought,		Charles Harris	30	0	0
Cashier, or Receiver-Gen Excise, &c. for himse	lf and	William Poyntz, Esq;	1980	0	0
Receivers \( \begin{aligned} \lambda 3d \\ 4th \end{aligned}, \\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	per Ann. ch 80 l. er Ann. per Ann.	Edward Spear Thomas Brereton Stephen Montage Daniel Cotterell Richard Wotton Edward Nichton	340	0	٥
Notary Pub- lick Clerks 2d, 60 l. p	h 40 l. 5	Edward Nickson Thomas Butler John Baskett William Omsley	240	•	0
Three Bill-Men, each 40 l.	per Ann.	Roger Church Mr. Boucher	120	0	0
Comptroller of the Cash, for and Clerks, 600 l. per A	r himself }	John Pennington, Esq;	600	0	0
His Two Clerks	{	Thomas Wallis John Bracken			
Auditor of Excise, &c. for and Clerks, 10301. per Auditor of Hides, Coffee, T	Ann.	Sir Bazil Dixwell, Bart.	1030	0	•
Chocolate, for himself a puty, Alex. Lefly, 300 l.	ind De-	John Temple, Esq;	300	0	•
Two General Examiners of cife and Malt Officers Books, each 100 l. per A	the Ex- }	Daniel Webb Robert Whinfield	200	0 (	<b>3</b>
Fourteen Affiftants for Exam 60 l. per Ann.		faid Books, each	840	, c	
Affifiant to the General-Example for Sorting the Books, 30 Ann.	in per }	Robert Clay	30 0	) 'o	)
	H	Carried over 2	3756 0	0	

Chief-Examiner of Town Officers Books for London-Brewery, 801.

Two Affistant-Examiners of the faid

Twelve Surveyors in the London

per Ann.

In the London

Brewery

4 Excise Li	Part II.				
	1.	s.	d.		
	Brought over	23756	0	0	
socks for London-Brewery, 80 l.	Edmund Clarke	80	0	0	
o Assistant-Examiners of the faid Books, each 60 l. per Ann. Excise, Hides, Plate, Cossee,	Thomas Nelson James Hayter	120	0	0	
Tea, and Victuallers, 190 l.	John Draper				
Candles, Coffee, &c. 145 l.	John Thorne	750	0	0	
Excise, Coffee, Tea, &c.	Thomas Davidson				
Soap only, 145 l. per Ann. Coffee, Tea, &c. 125 l. per Ann					
	George Gwynn James Mallard John Eathorne Richard Pike				
elve Surveyors in the London Rewery, each 80 l. per Ann.	Richard Jackson George Knight William Richardson Thomas Applebury	960	0	0	
	John Daniel Francis Smith George Janson Ewan Jenkins	•			
, C 26 Principal Officer	s, each 60 l. per Ann.	1560	0	0	
he London rewery \begin{cases} \frac{59}{38} \text{ Officers, each 5} \\ 38 \text{ Affiftants, each} \end{cases}	z l. per Ann.	3068 1520	0 0	0	
Diffillery.					
r General Surveyors of the Dif- llery, each 80 l. per Ann.	Joseph Bosley Ralph Holmes George Dalby Serjeant Glanville	320	o	٥	
Surveyors in the London Distilled		360	Ö.	o	
y-one Officers in Ditto, each 50		2050	0 0	0	

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	Joseph Bosley Ralph Holmes George Dalby Serjeant Glanwille	320	o	٥	
Six Surveyors in the London Diffiller	y, each 60 l. per	360	Ö.	0	
Forty-one Officers in Ditto, each 50	l. per Ann.	2050	0	0	
Twelve Affistants in Ditto, each 4	ol. per Ann.	480			
exciseable Liquors, at the Port of London, 120 l. per Ann.	Michael Warwick	120	0	0	The second second
		-			

Carried forward 35144

Chap. XIX. Excise Liff.			115	-
	1.	5	. d.	į
Brought forward	35144			
Port-Surveyor for the Distillery,	3.5 11			
Malt, Coffee, Tea, and Choco George Prat	90	0	0	
late, 90 l. per Ann.				
Land Surveyor of Imported Liquors, Francis Palmer	80	0	0	
00 t. per 21mi.				
Two General Surveyors in the Distillery, each 90 l. per Ann.		COST	0	
Four Surveyors in the Brandy, each 60 l. per Ann.	. 240			
In the Brandy, Fifty-two Officers, each 50 l. per Ann.	2600			
Coffee, Tea, &c. \ Twelve Affistants, each 40 l. per Ann. Two Port-Gaugers, each 60 l. per \ John Parry	480	0	0	
Two Port-Gaugers, each oo t. per John Parry	120	0	0	
Ann. Sames Frender				
Two Port Officers, each 50 l. per Spencer Dunbabin Ann.	100	0	0	
Ann.   William Laundy     Danjel Clarke				
Four Tide-Surveyors, each 60 l. per William Hart				
Ann. Major Maud	240	0	0	
William Scott				
Warehouse-Keeper at 60 / Acr Ann Ralph Scott	- 60	0	0	
Examiner of the London Diffillery Thomas Leaper Officers Books. 80/ per Ann  Officers Books. 80/ per Ann				
Officers Books, 80 l. per Ann. Thomas Leaper	80	0	0	
Eighteen Permit-Writers, in Excise, Cossee, Tea, &c. each				
601 her Ann	1080	0	0	
Chief Examiner of the Permits, 80 l. Ralph Trafford	0-	_	_	
per Ann.	80	0	0	
Five Assistants to ditto, each 60 l.per Ann.	300	0	0	
Eight Surveyors in the Soap, Candles, and Plate, each 70 l.	560	0	0	
per Ann.	300	٠	٠	
Fifty-one Officers in Candles and Soap, each 50 l. per Ann.	2550	0	0	
Thirty-four Assistants in Candles and Soap, each 40 l. per Ann.	1360	0	0	
Chief Examiner in the faid Duties, Mr. Richard Hazard	80	0	0	
oo i per mann				
Three Affistants to ditto, each 55 l. per Ann.	165			
Two Callico-Surveyors, each 60 l. per Ann.	120	0	0	
Three Officers in the said Duties, each 50 l. per Ann.	150	0		
Two Officers in Paper, each 50 l. per Ann.	100	0	0	
Two Officers in Wire, each 50 l. per Ann. One Assistant to ditto, at 40 l. per Ann.	40	0		
Four Officers in Starch, each 52 l. per Ann.	208	0	0	
Six Officers in Hides, each 50 l. per Ann.	300	0		
One Affistant in ditto, at 40 l. per Ann.	40	0	0	
Twenty-one Officers in Coffee and Tea, each 50 l. per Ann.	1050	0	0	
Two Port Officers in ditto each rol her Ann	100	0	0	
Surveyor for Gold and Silver Wire, John Gale		AFS.		
and Wrought Plate, 70 l. per Ann. John Gale	70	0	0	
Surveyor of the Hides 801 per Ann Stephen Howard	80	o	0	
Examiner of Town-Officers Books for Edmund Tanner.	6-			
Hides, at 65 l. per Ann.	65	0		

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Coffee, Ten, and	Chocolate.			
Inspector General of the said Duties, 500 l. per Ann.	Henry Robinson, Esq;	500	0	Q
Register of the Chocolate Stamps,	Thomas Spincks	80	0	0
Clerk of the Futures 601 per Ann	Thomas Pool	60	0	
Stamper of Labels for the Chocolate,	John Dale	50	0	
50 l. per Ann. Three Pasters for fixing on the Labels,		150	0	•
Two Surveyors of the Coffee-Roafting Houses, each 80 l. per Ann.	Samuel Game	160	0	0
Two Surveyors of the Warehouses for	Joseph Surbutt	160	0	0
Coffee and Tea, each 80 l. per Ann.	John Saffin			12
Six Warehouse-keepers, each 60 l. p. Warehouse-keeper of Condemned		360		
Goods at the Excise-Office, 40 l.		40	0	0
Six Lockers at the Tea Warehouses,	each 30l. per Ann.	180	0	0
Two Surveyors of the great Dealers in Coffee, Tea, &c. each 70 l.	Benjamin Monger Robert Rogers	140	0	0
Twenty-one Officers, each 50 l. per .	Ann.	1050	0	0
Six Permit-Writers, each 60 l. per A	Inn.	360		0
One Ditto, at 50 l. per Ann.		50	0	0
Three House-keepers at the Roasting houses, each 40 l. p. Ann.		140	0	0
Eleven Coffee-Roasters, at ditto		440	0	0
Twelve Watermen, each 30 l. per A	nn.	360	0	0
Thirty-fix Tidesmen, at 3 s. per Dien				
Six Lockers for the Customs, at 1 s.		,		
Six Warehouse-keepers, each 60 l. per Ann. Two Port-Officers for the Inland Duties, each 50 l. per Ann.			0	
Register of the Victuallers, within		100	0	Ò
the Weekly Bills of Mortality, on Account of the Pot Att, and Ac-	John Hone	80	0	0
comptant for Impress Money for paying of Incidents, at 80 l. p. Ann.	10000			
Siv Mellengere each end hen Ann		300	0	0
House-keeper of the Excise-Office, 200 l. per Ann.	Mrs. Mary Howard	200		0
Deputy House-keeper, 120 l. per Ann	Mrs Tahitha Metchel	120	0	0
Two Door-keepers to the Commissioners of Excise at 1st 801. p. Ann 2d 601. p. Ann		146	0	0
of Freile	Itenry Long	4		
Porter of the Excise-Office, at 40 l.	James Rolls	40	0	0
	Carried forward	53612	0	0

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			1	1.	3.	d.
	Brought fo	orwa	rd.	53612	0	
Six Watchmen at the Exci	ife-Office, each 40 l. per	Ann.		240		0
Yard-keeper and Fire-mak	ker, 40 l. William Hall	!		40		0
Stable-keeper, 50 l. per A	nn. Elizabeth Goo	debi	14	50	0	0
Rent paid for the Excise-Off	fice, 400 l. William Poyn	tz, l	Efq;	400		
There are 49 Collectors in t	the feveral Counties in En	glan	id. 7			
at a Salary of 120 l. per	Ann. each, and one a Sa besides an Allowance for I	pern	u-	5960	0	0
And 190 Supervisors, who	are fet over, and do info	t Be	he (			142
feveral Officers in the C Ann. besides an Allowan	Country, at a Salary of oc	1. 1	er	17100	0	•
Most Collectors have a Convery Collection.	lerk and Supernumerary O	ffice	r in			
There are common Officers of England, about 2700	employ'd in the several, each at 50 l. per Ann.	Part	3}1	35000	0	0
			, -	10100		I
Places by the Commission 1500 l. are raised every 2 for the Support of old of Excise, who have served they are allowed per Annu	is, &c. which are put into ners; by which means Year, which Money is a decayed, or disabled Offi- d upwards of Seven Year.	the 14 ppli cers	eir or ed of	12402	4	910
An Accomptant-General -	50	0	0			
A Collector	-25	0	0			
A Clerk	20	0	0			
A Supervifor		0	0			
A Gauger —	10	0	0			
At D. This Change is	missed to show Continue					
they are; and they are pai	mitted to them Gratis wh	erev	er			

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